DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

WATER-SUPPLY PAPER 340

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

1885–1913

COMPILED BY B. D. WOOD

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

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STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES, 1885–1913.

Compiled by B. D. Wood.

Part I. NORTH ATLANTIC COAST DRAINAGE BASINS.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below.

Part I. North Atlantic coast basins.
II. South Atlantic coast and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific coast basins in California.
XII. North Pacific coast basins.

The North Atlantic coast section, to which this part pertains, includes the area drained by streams flowing into the Atlantic Ocean from St. John River in Maine to York River, Va., inclusive. The principal streams in this division are the St. Croix, Machias, Union, Penobscot, Kennebec, Androscoggin, Saco, Merrimac, Mystic, Blackstone, Connecticut, Hudson, Delaware, Susquehanna, Potomac, and Rappahannock. The streams drain wholly or in part the States

of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia.

This part contains, in addition to the annotated list of publications relating specifically to the section, a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects; also brief references to reports published by State and other organizations (p. 19).

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
St. Paul, Minn., Old Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 505 Custom House.
Los Angeles, Cal., Federal Building.
Santa Fe, N. Mex., Capitol Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,000 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; WS=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332[a]	do	1912.
WS 351 to 362[a]	do	1913.

[a] In preparation.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The table which follows gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1912. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1913, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, and 351, which contain records for the New England streams from 1903 to 1913. Results of miscellaneous measurements are published by drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899–1913.

	1899 [a]	1900 [b]	1901	1902	1903	1904	1905	1906	1907–8	1909	1910	1911	1912	1913
North Atlantic coast	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125, [f] 126	[d] 165, [e] 166, [f] 167	[d] 201, [e] 202, [f] 203	241	261	281	301	321	351
South Atlantic coast and eastern Gulf of Mexico	[g] 35, 36	48	65, 75	[g] 82, 83	[g] 97, 98	[f] 126, 127	[f] 167, 168	[f] 203, 204	242	262	282	302	322	352
Ohio River basin	36	48, [h] 49	65, 75	83	98	128	169	205	243	263	283	303	323	353
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129	170	206	244	264	284	304	324	354
Hudson Bay and upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, [k] 100	[j] 128, 130	171	207	245	265	285	305	325	355
Missouri River	[l] 36, 37	49, [m] 50	66, 75	84	99	130, [n] 131	172	208	246	266	286	306	326	356
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131	[j] 169, 173	[j] 205, 209	247	267	287	307	327	357
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248	268	288	308	328	358
Colorado River	[o] 37, 38	50	66, 75	85	100	133	175, [p] 177	211	249	269	289	309	329	359
Great Basin	38, [q] 39	51	66, 75	85	100	133, [r] 134	176, [r] 177	212, [r] 213	250, [r] 251	270, [r] 271	290, [r] 291	310	330	360
California	38, [s] 39	51	66, 75	85	100	134	177	213	251	271	291	311	331	361
North Pacific Coast	38	51	66, 75	85	100	135	[t] 177, 178	214	252	272	292	312	332	362

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Hudson Bay only.
[l] Gallatin River.
[m] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[n] Platte and Kansas rivers.
[o] Green and Gunnison rivers and Grand River above junction with Gunnison.
[p] Below junction with Gila.
[q] Mohave River only.
[r] Great Basin in California, excepting Truckee and Carson drainage basins.
[s] Kings and Kern rivers only.
[t] Rogue, Umpqua, and Siletz rivers only.

In these papers and in the following list the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated on page 1, and in the records for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

GAGING STATIONS.[1]

NOTE.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinuance.

ST. JOHN RIVER BASIN.

St. John River near Dickey, Maine, 1910–11.
St. John River at Fort Kent, Maine, 1905–
St. John River at Van Buren, Maine, 1908–
    Allagash River near Allagash, Maine, 1910–11.
    St. Francis River at St. Francis, Maine, 1910–11.
    Fish River at Wallagrass, Maine, 1903–1908; 1911.
    Madawaska River at St. Rose du Degele, Quebec, 1910–1911.
    Aroostook River at Fort Fairfield, Maine, 1903–1910.

ST. CROIX RIVER BASIN.

St. Croix River near Woodland, Maine, 1902–1911.
    Grand Lake:
        West Branch St. Croix River at Baileyville, Maine, 1910–

MACHIAS RIVER BASIN.

Machias River at Whitneyville, Maine, 1903–

UNION RIVER BASIN.

Union River, West Branch (head of Union River), at Amherst, Maine, 1909–
Union River, West Branch, near Mariaville, Maine, 1909.
Union River at Ellsworth, Maine, 1909–10.
    Union River, East Branch, near Waltham, Maine, 1909.
    Webbs Brook at Waltham, Maine, 1909.
    Green Lake (head of Green Lake Stream) at Green Lake, Maine, 1909–
    Green Lake Stream at Lakewood, Maine, 1909–
    Branch Lake (head of Branch Lake Stream) near Ellsworth, Maine, 1909–
    Branch Lake Stream near Ellsworth, Maine, 1909–

[1] St. John River to York River, inclusive.

PENOBSCOT RIVER BASIN.

Penobscot River, West Branch (head of Penobscot), at Millinocket, Maine, 1901–
Penobscot River at West Enfield, Maine, 1901–
Penobscot River at Sunk Haze rips, near Costigan, Maine, 1899–1900.
Penobscot River, East Branch, at Grand Lake Dam, Maine, 1912.
Penobscot River, East Branch, at Grindstone, Maine, 1902–
Mattawamkeag River at Mattawamkeag, Maine, 1902–
Piscataquis River near Foxcroft, Maine, 1902–
Cold Stream Pond (head of Cold Stream), 1900–1911 (record of opening and closing of pond).
Cold Stream at Enfield, Maine, 1904–1906.
Kenduskeag Stream near Bangor, Maine, 1908–
Phillips Lake outlets at Holden and Dedham, Maine, 1904–1908.

KENNEBEC RIVER BASIN.

Moose River (head of Kennebec River) at Rockwood, Maine, 1902–1908; 1910–
Moosehead Lake (on Kennebec River) at Greenville, Maine, 1903–1908 (stage only).
Moosehead Lake at East outlet, Maine, 1895– (stage only).
Kennebec River at The Forks, Maine, 1901–
Kennebec River at Bingham, Maine, 1907–1910.
Kennebec River at North Anson, Maine, 1901–1907.
Kennebec River at Waterville, Maine, 1891–
Kennebec River at Gardiner, Maine, 1785–1910 (record of opening and closing of navigation).
Roach River at Roach River, Maine, 1901–1908.
Dead River at The Forks, Maine, 1901–1907; 1910–
Carrabassett River at North Anson, Maine, 1901–1907.
Sandy River at Farmington, Maine, 1910–
Sandy River at Madison, Maine, 1904–1908.
Sebasticook River at Pittsfield, Maine, 1908–
Messalonskee Stream at Waterville, Maine, 1903–1905.
Cobbosseecontee Lake, Maine, 1839–1911 (dates of opening and closing).
Cobbosseecontee Stream at Gardiner, Maine, 1890–

ANDROSCOGGIN RIVER BASIN.

Rangeley Lake (head of Androscoggin River), Maine, 1879–1911 (dates of opening and closing).
Androscoggin River at Errol Dam, N. H., 1905–
Androscoggin River at Gorham, N. H., 1903 (fragmentary).
Androscoggin River at Shelburne, N. H., 1903–1907 and 1910.
Androscoggin River at Rumford Falls, Maine, 1892–
Androscoggin River at Dixfield, Maine, 1902–1908.
Auburn Lake, Maine, 1890–1911 (date of opening).

PRESUMPSCOT RIVER BASIN.

Presumpscot River at outlet of Sebago Lake, Maine, 1887–

SACO RIVER BASIN.

Saco River near Center Conway, N. H., 1903–1912.
Saco River at West Buxton, Maine, 1907–

MERRIMAC RIVER BASIN.

Pemigewasset River (head of Merrimac River) at Plymouth, N. H., 1886–
Merrimac River at Franklin Junction, N. H., 1903–
Merrimac River at Garvins Falls, N. H., 1904–
Merrimac River at Lawrence, Mass., 1890–
Lake Winnipesaukee at Lakeport, N. H., 1860– (Stage only).
Contoocook River at West Hopkinton, N. H., 1903–1907.
Suncook River at East Pembroke, N. H., 1904–5.
Souhegan River at Merrimac, N. H., 1909–
South Branch of Nashua River at Clinton, Mass., 1896–
Sudbury River at Framingham, Mass., 1875–
Lake Cochituate at Cochituate, Mass., 1863–

MYSTIC RIVER BASIN.

Mystic Lake near Boston, Mass., 1878–1897.

TAUNTON RIVER BASIN.

Matfield River at Elmwood, Mass., 1909–10.
Sautucket River near Elmwood, Mass., 1909–10.

TENMILE RIVER BASIN.

Tenmile River near Rumford, R. I., 1909.

BLACKSTONE RIVER BASIN.

Blackstone River at Woonsocket, R. I., 1904–5.
Blackstone River at Berkeley, R. I., 1901–1902.
Branch River at Branch Village, R. I., 1909–

WOONASQUATUCKETT RIVER BASIN.

Woonasquatuckett River at Olneyville, R. I., 1910.

PAWTUXET RIVER BASIN.

Pawtuxet River at Harris, R. I., 1909–10.

PAWCATUCK RIVER BASIN.

Wood River at Hope Valley, R. I., 1909–10.

THAMES RIVER BASIN.

Shetucket River at Willimantic, Conn., 1904–5.

CONNECTICUT RIVER BASIN.

Connecticut River at Orford, N. H., 1900–
Connecticut River at Sunderland, Mass., 1904–
Connecticut River at Holyoke, Mass., 1880–1898.
Connecticut River at Hartford, Conn., 1896–1908.
Connecticut River at Sunderland, Mass., 1904–
Israel River above South Branch at Jefferson Highlands, N. H., 1903–1906.
Israel River below South Branch at Jefferson Highlands, N. H., 1903–1907.
Passumpsic River at St. Johnsbury Center, Vt., 1903 and 1909–
Ammonoosuc River at Bretton Woods, N. H., 1903–1907.
Zealand River at Twin Mountain, N. H., 1903–1907.
Little River at Twin Mountain, N. H., 1904–5.

Connecticut River tributaries—Continued.
White River at Sharon, Vt., 1903–1905 and 1909–
Ashuelot River at Winchester, N. H., 1903–1905.
Ashuelot River at Hinsdale, N. H., 1907–1911.
Millers River at Wendell, Mass., 1909–1913.
Moss Brook, Wendell, Mass., 1910–
Deerfield River at Hoosac Tunnel, Mass., 1909–
Deerfield River at Shelburne Falls, Mass., 1907–
Deerfield River at Deerfield, Mass., 1904–5.
Chicopee River:
Ware River at Ware, Mass., 1904–1910; 1911–
Ware River at Gibbs Crossing, Mass., 1912–
Burnshirt River near Templeton, Mass., 1909–10.
Swift River at West Ware, Mass., 1910–
Quaboag River at West Warren, Mass., 1904–1907.
Quaboag River at West Brimfield, Mass., 1909–
Westfield River at Knightville, Mass., 1909–
Westfield River at Russell, Mass., 1904–5.
Westfield River, Middle Branch, Goss Heights, Mass., 1910.
Westfield Little River near Blandford, Mass., 1905–
Salmon River at Leesville, Conn., 1905–6.

HOUSATONIC RIVER BASIN.

Housatonic River at Great Barrington, Mass., 1913–
Housatonic River at Gaylordsville, Conn., 1900–
Tenmile River at Dover Plains, N. Y., 1901–1903.

MIANUS RIVER BASIN.

Mianus River near Stamford, Conn., 1903.
Mianus River at Bedford, N. Y., 1903.

BYRAM RIVER BASIN.

Byram River at Pemberwick, Conn., 1903.
Byram River, West Branch, near Port Chester, N. Y., 1903.
Byram River, East Branch, near Greenwich, Conn., 1903.
Byram River, Middle Branch, near Riverville, Conn., 1903–4.

HUDSON RIVER BASIN.

Hudson River at North Creek, N. Y., 1907–
Hudson River at Thurman, N. Y., 1907–
Hudson River at Fort Edward, N. Y., 1895–1908.
Hudson River at Corinth, N. Y., 1904–
Hudson River at Mechanicville, N. Y., 1888–
Hudson River at Spier Falls, N. Y., 1912–
Cedar River near Indian Lake, N. Y., 1910–
Indian Lake Reservoir at Indian Lake, N. Y., 1900–
Indian River below Indian Lake, N. Y., 1912–
Schroon Lake (head of Schroon River) at Pottersville, N. Y., 1908–1910.
Schroon River at Riverbank, N. Y., 1907–
Schroon River at Warrensburg, N. Y., 1895–1902.
Sacandaga River at Wells, N. Y., 1907–1911.
Sacandaga River at Northville, N. Y., 1907–1910.
Sacandaga River near Hope, N. Y., 1911–

Hudson River tributaries—Continued.
Sacandaga River near Hadley, N. Y., 1907–1910.
Sacandaga River (at cable) near Hadley, N. Y., 1910–
Sacandaga River at Union Bag & Paper Co.'s mill at Hadley, N. Y., 1909–1911.
Sacandaga River, West Branch, at Whitehouse, N. Y., 1910–11.
Sacandaga River, West Branch, near Blackbridge, N. Y., 1911–
Battenkill River at Battenville, N. Y., 1908.
Fish Creek at Burgoyne, N. Y., 1904–5; 1908.
Hoosic River above Eagle Bridge, N. Y., 1910–
Hoosic River at Buskirk, N. Y., 1903–1909.
Mohawk River at Ridge Mills near Rome, N. Y., 1898–1900.
Mohawk River at Utica, N. Y., 1901–1903.
Mohawk River at Little Falls, N. Y., 1898–
Mohawk River at Rocky Rift dam near Indian Castle, N. Y., 1901.
Mohawk River at Schenectady, N. Y., 1899–1901.
Mohawk River at Rexford Flats, N. Y., 1898–1901.
Mohawk River at Dunsbach Ferry, N. Y., 1898–
Ninemile Creek at Stittville, N. Y., 1898–9.
Oriskany Creek at Coleman, N. Y., 1904–1906.
Oriskany Creek at Wood Road Bridge, near Oriskany, N. Y., 1901–1904.
Oriskany Creek at Oriskany State dam near Oriskany, N. Y., 1898–1906.
Saquoit Creek at New York Mills, N. Y., 1898–1900.
Nail Creek at Utica, N. Y., 1904.
Reels Creek at Deerfield, N. Y., 1901–1904.
Reels Creek at Utica, N. Y., 1901–2.
Johnson Brook at Deerfield, N. Y., 1903–1905.
Starch Factory Creek at New Hartford, N. Y., 1903–1906.
Graefenberg Creek at New Hartford, N. Y., 1903–1906.
Sylvan Glen Creek at New Hartford, N. Y., 1900–1906.
West Canada Creek at Twin Rock Bridge, near Trenton Falls, N. Y., 1900–
West Canada Creek at Middleville, N. Y., 1898–1901.
West Canada Creek at East Bridge, N. Y., 1905–
East Canada Creek at Dolgeville, N. Y., 1898–
Garoga Creek 3 miles above junction with Mohawk River, 1898–99.
Cayadutta Creek at Johnstown, N. Y., 1899–1901.
Schoharie Creek at Prattsville, N. Y., 1902–
Schoharie Creek at Schoharie Falls above Mill Point, 1900–1901.
Schoharie Creek at Mill Point, N. Y., 1900–1903.
Schoharie Creek at Fort Hunter, 1898–1901.
Schoharie Creek at Erie Canal aqueduct, below Fort Hunter, N. Y., 1900.
Quackenkill Creek at Quackenkill, N. Y., 1894.
Normanskill Creek at Frenchs Mill, N. Y., 1891.
Kinderhook Creek at Wilsons Dam near Garfield, N. Y., 1893–94.
Kinderhook Creek at East Nassau, N. Y., 1892–1894.
Kinderhook Creek at Rossman, N. Y., 1906–
Catskill Creek at South Cairo, N. Y., 1901–1907.
Esopus Creek at Olivebridge, N. Y., 1903–4.
Esopus Creek near Olivebridge, N. Y. (weir station), 1906–
Esopus Creek at Kingston, N. Y., 1901–1909.
Esopus Creek at Mount Marion, N. Y., 1907–
Rondout Creek at Rosendale, N. Y., 1901–1903; 1905–
Diversion to Delaware and Hudson Canal at Rosendale, 1901–1907.
Wallkill River at Newpaltz, N. Y., 1901–1903.
Wappinger Creek at Wappinger Falls, N. Y., 1903–1905.

Hudson River tributaries—Continued.
Fishkill Creek at Glenham, N. Y., 1901–1903.
Foundry Brook at Coldspring, N. Y., 1902–3.
Croton River at Croton dam, near Croton Lake, N. Y., 1868–1899.

PASSAIC RIVER BASIN.

Passaic River at Millington, N. J., 1903–1906.
Passaic River near Chatham, N. J., 1902–
Passaic River at Two Bridges (Mountain View), N. J., 1901–1903.
Rockaway River at Boonton, N. J., 1903–4.
Pompton River at Pompton Plains, N. J., 1903–4.
Pompton River at Two Bridges (Mountain View), N. J., 1901–1903.
Ramapo River near Mahwah, N. J., 1903–1908.
Wanaque River at Wanaque, N. J., 1903–1905.

RARITAN RIVER BASIN.

Raritan River at Stanton, N. J., 1903–1906.
Raritan River at Finderne, N. J., 1903–1907.
Raritan River at Boundbrook, N. J., 1903–1909.
Raritan River, North Branch, at Pluckemin, N. J., 1903–1906.
Millstone River at Millstone, N. J., 1903–4.

DELAWARE RIVER BASIN.

Delaware River, East Branch (head of Delaware River), at Hancock, N. Y., 1902–
Delaware River, East Branch, at Fish's Eddy, N. Y., 1912–
Delaware River at Port Jervis, N. Y., 1904–
Delaware River at Riegelsville, N. J., 1906–
Delaware River at Lambertville, N. J., 1897–1908.
Delaware River, West Branch, at Hancock, N. Y., 1902–
Delaware River, West Branch, at Hales Eddy, N. Y., 1912–
Mongaup River near Rio, N. Y., 1909–
Neversink River at Godeffroy, N. Y., 1903; 1909–10; 1911–
Neversink River at Port Jervis, N. Y., 1902–3.
Paulins Kill at Columbia, N. J., 1908–9.
Lehigh River at South Bethlehem, Pa., 1902–1905; 1909–
Lehigh River at Easton, Pa., 1909.
Musconetcong River at Asbury, N. J., 1903.
Musconetcong River near Bloomsbury, N. J., 1903–1907.
Tohickon Creek at Point Pleasant, Pa., 1883–
Neshaminy Creek below Forks, Pa., 1884–
Schuylkill River near Philadelphia, Pa., 1898–
Perkiomen Creek near Frederick, Pa., 1884–
Wissahickon Creek at Philadelphia, Pa., 1897–1906.

SUSQUEHANNA RIVER BASIN.

Susquehanna River at Colliersville, N. Y., 1907–8.
Susquehanna River at Binghampton, N. Y., 1901–1912.
Susquehanna River at Conklin, N. Y., 1912–
Susquehanna River at Wysox, Pa., 1908–9.
Susquehanna River at Wilkes-Barre, Pa., 1899–
Susquehanna River at Danville, Pa., 1899–
Susquehanna River at Harrisburg, Pa., 1891–

Susquehanna River at McCalls Ferry, Pa., 1902–1909.
Chenango River at South Oxford, N. Y., 1903.
Chenango River near Greene, N. Y., 1908.
Chenango River at Binghampton, N. Y., 1901–1912.
Chenango River at Chenango Forks, N. Y., 1912–
Eaton Brook, Madison County, N. Y., 1835.
Madison Brook, Madison County, N. Y., 1835.
Tioughnioga River at Chenango Forks, N. Y., 1903.
Cayuta Creek at Waverly, N. Y., 1898–1902 (data in Water Supply Paper 109 only).
Chemung River at Chemung, N. Y., 1903–
Susquehanna River, West Branch, at Williamsport, Pa., 1895–
Susquehanna River, West Branch, at Allenwood, Pa., 1899–1902.
Juniata River at Newport, Pa., 1899–
Broad Creek at Mill Green, Md., 1904–1909.
Octoraro Creek at Rowlandsville, Md., 1896–1899.
Deer Creek near Churchville, Md., 1904–1909.

GUNPOWDER RIVER BASIN.

Gunpowder Falls at Glencoe, Md., 1904–1909.
Little Gunpowder Falls near Belair, Md., 1904–1909.

PATAPSCO RIVER BASIN.

Patapsco River at Woodstock, Md., 1896–1909.

PATUXENT RIVER BASIN.

Patuxent River at Laurel, Md., 1896–1898.

POTOMAC RIVER BASIN.

Potomac River, North Branch (head of Potomac), at Piedmont, W. Va., 1899–1906.
Potomac River, North Branch, at Cumberland, Md., 1894–1897.
Potomac River at Great Cacapon, W. Va., 1894–1896.
Potomac River at Point of Rocks, Md., 1895–
Potomac River at Chain Bridge, near Washington, D. C., 1891–1895.
Savage River at Bloomington, Md., 1905–6.
Georges Creek at Westernport, Md., 1905–6.
Wills Creek near Cumberland, Md., 1905–6.
Potomac River, South Branch, near Springfield, W. Va., 1894–1896; 1899–1906.
Opequan Creek near Martinsburg, W. Va., 1905–6.
Tuscarora Creek at Martinsburg, W. Va., 1905.
Antietam Creek near Sharpsburg, Md., 1897–1905.
South River at Basic City, Va., 1905–6.
South River at Port Republic, Va., 1895–1899.
Shenandoah River, South Fork (head of Shenandoah River), near Front Royal, Va., 1899–1906.
Shenandoah River at Millville, W. Va., 1895–1909.
North River at Port Republic, Va., 1895–1899.
Lewis Creek near Staunton, Va., 1905–6.
Cooks Creek at Mount Crawford, Va., 1905–6.
Elk Run at Elkton, Va., 1905–6.
Hawksbill Creek near Luray, Va., 1905–6.
Shenandoah River, North Fork, near Riverton, Va., 1899–1906.
Passage Creek at Buckton, Va., 1905–6.

Potomac River tributaries—Continued.
Monocacy River near Frederick, Md., 1896–
Goose Creek near Leesburg, Va., 1909–
Rock Creek at Zoological Park, District of Columbia, 1897–1900.
Rock Creek at Lyons Mill, District of Columbia, 1892–1894.
Occoquan Creek near Occoquan, Va., 1913–

RAPPAHANNOCK RIVER BASIN.

Rappahannock River near Fredericksburg, Va., 1907–

REPORTS ON WATER RESOURCES OF NORTH ATLANTIC COAST.[1]

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*24. Water resources of the State of New York, Part I, by G. W. Rafter, 1899, 99 pp., 13 pls.

Describes the principal rivers of New York and their more important tributaries, and gives data on temperature, precipitation, evaporation, and stream flow.

*25. Water resources of the State of New York, Part II, by G. W. Rafter, 1899, 100 pp., 12 pls.

Contains discussion of water storage projects on Genessee and Hudson rivers, power development at Niagara Falls, descriptions and early history of State canals, and a chapter on the use and value of the water powers of the streams and canals; also brief discussion of the water yield of land areas of Long Island.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls.

Gives elevations and distances along rivers of the United States, also brief descriptions of many of the streams, including St. Criox, Penobscot, Kennebec, Androscoggin, Saco, Merrimac Connecticut, Housatonic, Hudson, Mohawk, Delaware, Lehigh, Schuylkill, Susquehanna, Juniata, Potomac, and James rivers. 15c.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

*69. Water powers of the State of Maine, by H. A. Pressey. 1902. 124 pp., 14 pls. 20c.

Discusses briefly the geology and forests of Maine and in somewhat greater detail the drainage areas, lake storage, and water powers of the St. Croix, Penobscot, Kennebec, Androscoggin, Presumpscot, Saco, and St. John rivers, and the minor coastal streams; mentions also developed, tidal powers.

*72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the water of Raritan, Passaic, and Hudson rivers and their tributaries and the damage resulting from pollution.

[1] For stream-measurement reports see tables on pages 3–4.

*76. Observations on the flow of rivers in the vicinity of New York City, by H. A. Pressey. 1903. 108 pp., 13 pls. 15c.

Describes methods of measuring stream flow in open channels and under ice, and the quality of the river waters as determined by tests of turbidity, color, alkalinity, and permanent hardness. The streams considered are Catskill, Esopus, Rondout, and Fishkill creeks, and Wallkill, Tenmile, and Housatonic rivers.

*79. Normal and polluted waters in northeastern United States, by M. O. Leighton, 1903. 192 pp. 10c.

Defines essential qualities of water for various uses, the impurities in rain, surface, and underground waters, the meaning and importance of sanitary analyses, and the principal sources of pollution; chiefly "a review of the more readily available records" of examination of water supplies derived from streams in the Merrimac, Connecticut, Housatonic, Delaware, and Ohio River basins; contains many analyses.

88. The Passaic flood of 1902, by G. B. Hollister and M. O. Leighton. 1903. 56 pp., 15 pls. 15c.

Describes the topography of the area drained by the Passaic and its principal tributaries, discusses flood-flow and losses caused by the floods, and makes comparison with previous floods; suggests construction of dam at Mountain View to control flood flow. (See also No. 92.)

*92. The Passaic flood of 1903, by M. O. Leighton. 1904. 48 pp., 7 pls. 5c.

Discusses flood damages and preventive measures. (See No. 88.)

*102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on the wells and springs of the New England States and New York. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, material penetrated, temperature, use, and quality; many miscellaneous analyses.

*106. Water resources of the Philadelphia district, by Florence Bascom. 1904. 75 pp., 4 pls. 5c.

Describes the physiography, stratigraphic geology, rainfall, streams, ponds, springs, deep and artesian wells, and public water supplies of the area mapped on the Germantown, Norristown, Philadelphia, and Chester atlas sheets of the United States Geological Survey; compares quality of Delaware and Schuylkill River waters.

*108. Quality of water in the Susquehanna River drainage basin, by M. O. Leighton, with an introductory chapter on physiographic features, by G. B. Hollister. 1904. 76 pp., 4 pls. 15c.

*109. Hydrography of the Susquehanna River drainage basin, by J. C. Hoyt and R. H. Anderson. 1905. 215 pp., 29 pls. 25c.

The scope of No. 108 is sufficiently indicated by its title. No. 109 describes the physical features of the area drained by the Susquehanna and its tributaries, contains the results of measurements of flow at the gaging stations, and discusses precipitation, floods, low water, and water powers.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains brief reports on water resources, surface and underground, of districts in the North Atlantic coast drainage basins, as shown by the following list:

Drilled wells of the Triassic area of the Connecticut Valley, by W. H. C. Pynchon.

Triassic rocks of the Connecticut Valley as a source of water supply, by M. L. Fuller. Scope indicated by title.

Water resources of the Taconic quadrangle, New York, Massachusetts, and Vermont, by F. B. Taylor. Discusses rainfall, drainage, water powers, lakes and ponds, underground waters, and mineral springs; also quality of spring water as indicated by chemical and sanitary analyses of Sand Spring, near Williamstown.

Water resources of the Watkins Glen quadrangle, New York, by Ralph S. Tarr. Discusses the use of the surface and underground waters for municipal supplies and their quality as indicated by examination of Sixmile and Fall creeks, and sanitary analyses of well water at Ithaca.

Water resources of the central and southwestern highlands of New Jersey, by Laurence La Forge. Treats of population, industries, climate, and soils, lakes, ponds, swamps and rivers, mineral springs (with analyses), water power, the Morris Canal; present and prospective sources and quality of municipal supplies.

110. Contributions to the hydrology of eastern United States, 1904—Continued.

Water resources of the Chambersburg and Mercersburg quadrangles, Pennsylvania, by George W. Stose. Describes streams and springs.

Water resources of the Curwensville, Patton, Ebensburg, and Barnesboro quadrangles, Pennsylvania, by F. G. Clapp. Treats briefly of surface and underground waters and their use for municipal supplies; gives analyses of waters at Cresson Springs.

Water resources of the Elders Ridge quadrangle, Pennsylvania, by Ralph W. Stone. Water resources of the Waynesburg quadrangle, Pennsylvania, by Ralph W. Stone. Water resources of the Accident and Grantsville quadrangles, Maryland, by G. C. Martin. Water resources of the Frostburg and Flintstone quadrangles, Maryland and West Virginia, by G. C. Martin. Four short reports describing the relief, drainage, streams, springs, and artesian water supplies of units of the geologic atlas of the United States.

*114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports on water supplies of the North Atlantic States as follows:
Maine, by W. S. Bayley.
New Hampshire, by M. L. Fuller.
Vermont, by G. H. Perkins.
Massachusetts and Rhode Island, by W. O. Crosby.
Connecticut, by H. E. Gregory.
New York, by F. B. Weeks.
New Jersey, by G. N. Knapp.
Pennsylvania, by M. L. Fuller.
Delaware, by N. H. Darton.
Maryland, by N. H. Darton and M. L. Fuller.
District of Columbia, by N. H. Darton and M. L. Fuller.
Virginia, by N. H. Darton and M. L. Fuller.

Each of these reports discusses the resources of the public and private water supplies and related subjects, and gives list of pertinent publications; mineral springs are listed and sales of mineral water are reported.

*140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Contains chapter on measurement of rate of underflow on Long Island, N. Y.

*144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

*145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains several brief reports relating chiefly to areas in the North Atlantic coast drainage basins, as follows:

Water resources of the Portsmouth-York region, New Hampshire and Maine, by George Otis Smith. Gives results of investigations made for the War Department to determine water supplies available for forts at mouth of harbor.

Water supply from glacial gravels near Augusta, Maine, by George Otis Smith. Describes the Silver Lake system of ponds near Augusta and the series of springs at the head of Spring Brook.

Water resources of the Pawpaw and Hancock quadrangles, West Virginia, Maryland, and Pennsylvania, by George W. Stose and George C. Martin. Describes rocks, springs, and streams in the area at the northernmost bend of the Potomac; discusses history of development, character of water (with analysis), flow, and origin of Berkeley Springs.

Water of a gravel-filled valley near Tully, N. Y., by George B. Hollister. Describes character of the sands and gravels, the volume of the springs issuing from them, deposits of tufa, the waters of the lakes, and the composition of the spring and lake waters; analyses.

*147. Destructive floods in United States in 1904, by E. C. Murphy. 15c.

Describes floods on Susquehanna and Mohawk rivers and near Johnstown, Pa.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*155, Fluctuations of the water level in wells, with special reference to Long Island, New York, by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Contains accounts of floods in North Atlantic coast drainage basins as follows: Flood on Poquonnock River, Connecticut, by T. W. Norcross; flood on the Unadilla and Chenango rivers, New York, by R. E. Horton and C. C. Covert; also estimates of flood discharge and frequency on Kennebec, Androscoggin, Merrimac, Connecticut, Hudson, Passaic, Raritan, Delaware, Susquehanna, and Potomac Rivers; gives index to literature on floods on American streams.

185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*192. The Potomac River basin (Geographic history; Rainfall and stream flow; Pollution, typhoid fever, and character of water; Relation of soils and forest cover to quality and quantity of surface water; Effect of industrial wastes on fishes), by H. N. Parker, Bailey Willis, R. H. Bolster, W. W. Ashe, and M. C. Marsh. 1907. 364 pp., 10 pls. 60c.

Scope indicated by title.

*198. Water resources of the Kennebec River basin, by H. K. Barrows, with a section on the quality of Kennebec River water, by G. C. Whipple. 1907. 235 pp. 7 pls. 30c.

Describes physical characteristics and geology of the basin, the flow of the streams, evaporation, floods, developed and undeveloped water powers, water storage, log driving, and lumbering; under quality of water discusses effect of tides, pollution, and the epidemic of typhoid fever in 1902–3; contains gazetteer of rivers, lakes, and ponds.

223. Underground waters of southern Maine, by F. G. Clapp, with records of deep wells, by W. S. Bayley. 1908. 268 pp., 24 pls. 55c.

Describes physiography, rivers, water-bearing rocks, amount, source, and temperature of the ground waters, recovery of waters by springs, collection galleries and tunnels, and wells; discusses well-drilling methods, municipal water supplies, and the chemical composition of the ground waters; gives details for each county.

232. Underground water resources of Connecticut, by H. E. Gregory, with a study of the occurrence of water in crystalline rocks, by E. E. Ellis. 1909. 200 pp., 5 pls. 20c.

Describes physiographic features, drainage, forests, climate, streams, lakes, population and industries, rocks; circulation, amount, temperature and contamination of ground water; discusses the ground waters of the crystalline rocks, the Triassic sandstones and traps, and the glacial drift; the quality of the ground waters (with analyses); well construction; temperature, volume, character, uses, and production of spring waters.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Androscoggin, Hudson, Raritan, Delaware, Susquehanna, Lehigh, Potomac, and Shenandoah rivers.

*258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 125 pp., 2 pls. 15c.

Contains four brief reports pertaining especially to districts in the North Atlantic coast drainage area:

Occurrence and composition of well waters in the slates of Maine, by F. G. Clapp. Analyses.

Occurrence and composition of well waters in the granites of New England, by F. G. Clapp. Discusses proportion of successful wells, and water supply and depth. Analyses.

Composition of mineral springs in Maine, by F. G. Clapp.

Saline artesian waters of the Atlantic Coastal Plain, by Samuel Sanford.

Underground waters near Manassas, Va., by F. G. Clapp.

*279. Water resources of the Penobscot River basin, Maine, by H. K. Barrows and C. C. Babb. 1912. 285 pp., 19 pls. 65c.

Describes the topography, drainage, geology, forests, population, industries, transportation lines, and precipitation in the basin; gives results of investigations of stream flow at gaging stations; discusses relation of run-off to precipitation, evaporation, floods, low water, developed and undeveloped water powers, storage, log driving, and lumbering; contains gazetteer of rivers, lakes, and ponds.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Sixth Annual Report of the United States Geological Survey, 1884–85, J. W. Powell, Director. 1885. xxix, 570 pp., 65 pls. Cloth $2.00. Contains:

Seacoast swamps of the eastern United States, by N. S. Shaler. pp. 353–398. Describes the coast swamps of New England; discusses economic problems connected with marine swamps; gives a detailed account of selected areas of salt marsh lands, and a list of the principal areas of salt marshes between the Hudson River and Portland, Maine.

Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. Pt. I. Geology, xv, 774 pp., 98 pls. Cloth $2.35. Contains:

General account of the fresh-water morasses of the United States, with a description of the Dismal Swamp district of Virginia and North Carolina, by N. S. Shaler, pp. 255–339, Pls. VI to XIX. Scope indicated by title.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. Pt. II. Accompanying papers, xx, 597 pp., 73 pls. Cloth $2.10. Contains:

Potable waters of the eastern United States, by W J McGee, pp. 1 to 47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*44. Underground water resources of Long Island, N. Y., by A. C. Veatch, C. S. Slichter, Isaiah Bowman, W. O. Crosby, and R. E. Horton. 1906. 394 pp., 34 pls. $1.25.

Describes the geologic formations, the source of the ground waters, and requisite conditions for flowing wells; the springs, streams, ponds, and lakes; artesian and deep wells; fluctuation of ground water table; blowing wells and water works; discusses measurements of velocity of underflow, the results of sizing and filtration tests, and the utilization of stream waters; gives well records and notes (with chemical analyses) concerning representative wells.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*138. Artesian-well prospects in the Atlantic Coastal Plain region, by N. H. Darton. 1896. 232 pp., 19 pls. 20c.

Describes the general geologic structure of the Atlantic Coastal Plain region and summarizes the conditions affecting subterranean water in the Coastal Plain; discusses the general geologic relations in New York, southern New Jersey, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, and eastern Georgia; gives for each of the States a list of the deep wells and discusses well prospects. The notes on the wells that follow the tabulated lists contain many well sections and analyses of the waters.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Connecticut, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, and District of Columbia, and detailed records of wells at Pleasantville and Atlantic Highlands, N. J., Tully, N. Y., and in Greene and Warren counties, Pa. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia, and detailed records of wells in Newcastle County, Del.; Cumberland County, Maine; Anne Arundel, St. Mary, and Talbot counties, Maryland; Hampshire County, Massachusetts; Monmouth County, New Jersey; Saratoga County, New York; and Somerset County, Pennsylvania. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163 inclusive are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher

[1] Index maps showing areas in the North Atlantic States covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184 inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

13. Fredericksburg, Virginia-Maryland, 1894. 5c.

23. Nomini, Maryland-Virginia, 1896. 5c.

*70. Washington, District of Columbia-Maryland-Virginia, 1900.

80. Norfolk, Virginia-North Carolina, 1902. 5c.

Describes the plains, Dismal Swamp, and the tidal marshes; discusses the reclamation of swamp lands and gives an account of the underground waters; gives sections of wells near Norfolk and at Fort Monroe, and analyses of waters from the test boring at Norfolk and the boring at Lambert Point.

*83. New York City (Paterson, Harlem, Staten Island, and Brooklyn quadrangles), New York-New Jersey, 1902.

Discusses the present and future water supply of New York City.

136. St. Marys, Maryland-Virginia, 1906. 5c

Discusses artesian wells.

137. Dover, Delaware-Maryland-New Jersey, 1906. 5c.

Describes the shallow and deep wells used as sources of water supply; gives section of well at Middletown, Del.

149. Penobscot Bay, Maine, 1907. 5c.

Describes the wells and springs; gives analyses of spring water from North Bluehill.

152. Patuxent, Maryland-District of Columbia, 1907. 5c.

Discusses the springs, shallow wells, and artesian wells.

*157. Passaic, New Jersey-New York, 1908.

Discusses the underground water of the quadrangle, including the cities of Newark, Hoboken, Jersey City, Paterson, Elizabeth, Passaic, Plainfield, Rahway, and Perth Amboy, and a portion of the city of New York; gives a list of the deep borings in the New Jersey portion of the quadrangle, and notes concerning wells on Staten Island, Long Island, Hoffman Island, and Governors Island.

158. Rockland, Maine, 1908. 5c.

Describes the water supply in Knox County, Maine, of which Rockland is the principal city; discusses the water obtained from wells drilled in limestone and granite, and the city water supply of Camden, Rockport, Rockland, and Thomaston.

160. Accident-Grantsville, Maryland-Pennsylvania-West Virginia, 1908. 5c.

Describes two quadrangles lying chiefly in Garrett County, Md.; the waters of the Accident quadrangle pass north and west to rivers that join the Ohio; those of the Grantsville quadrangle are about equally divided between tributaries of the Ohio and of Savage River and Georges Creek which flow into the Potomac; under "Mineral Resources" the folio describes Youghiogheny and Castleman rivers, Savage River, and Georges Creek, and the spring waters; notes possibility of obtaining artesian water.

161. Franklin Furnace, New Jersey, 1908. 5c.

Describes the streams, water powers, and ground waters of a district in northwestern New Jersey, mainly in Sussex County but including also a small part of Morris County; gives tabulated list of water powers and of bored wells.

*162. Philadelphia (Norristown, Germantown, Chester, and Philadelphia quadrangles), Pennsylvania-New Jersey-Delaware, 1909.

Describes the tributaries of the Delaware that traverse the area, the underground waters of the Piedmont Plateau and the Coastal Plain, and gives a tabulated list of wells; discusses the water supply of Philadelphia and Camden, also suburban towns; gives analyses of filtered water of Pickering Creek.

167. Trenton, New Jersey-Pennsylvania, 1909. 5c.

Describes streams tributary to Raritan and Delaware rivers (including estimates of capacity with and without storage) and the springs and wells; discusses also the public water supply of Trenton and suburban towns.

169. Watkins Glen-Catatonk, New York, 1909. 5c.

Describes the rivers which include tributaries of the Susquehanna and the St. Lawrence, the lakes and swamps, and, under "Economic geology," springs and shallow and deep wells; discusses also water supply at Ithaca.

170. Mercersburg-Chambersburg, Pennsylvania, 1909. 5c.

Describes two quadrangles which are drained almost wholly into Potomac River chiefly through Conococheague Creek and its tributaries; describes the underground waters, including limestone springs, sandstone springs, and wells, and mentions briefly the sources of the water supplies of the principal towns.

182. Choptank, Maryland, 1912. 5c.

The Choptank quadrangle includes the entire width of Chesapeake Bay and portions of many large estuaries.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have, from time to time, published reports relating to the water resources of various sections of the country. Notable among those pertaining to the North Atlantic States are the reports of the Maine State Water Storage Commission (Augusta), the New Hampshire Forestry Commission (Concord), the Metropolitan Water and Sewerage Board (Boston, Mass.), the New York State Water Supply Commission (Albany), the New York State Conservation Commission (Albany), the New York State engineer and surveyor (Albany), the various commissions on water supply of New York City, the Geological Survey of New Jersey (Trenton), State boards of health, and the Tenth Census (vol. 16).

The following reports deserve special mention:

Water power of Maine, by Walter Wells, Augusta, 1869.

Hydrology of the State of New York, by G. W. Rafter; New York State Museum Bull. 85, 1905.

Hydrography of Virginia, by N. C. Grover and R. H. Bolster: Virginia Geol. Survey Bull. 3, 1906.

Underground waters of the Coastal Plain province of Virginia, by Samuel Sanford: Virginia Geol. Survey Bull. 5, 1913.

Many of these reports can be obtained by applying to the several commissions, and most of them can be consulted in the public libraries of the larger cities.

Part II. SOUTH ATLANTIC COAST AND EASTERN GULF OF MEXICO DRAINAGE BASINS.

PRINCIPAL STREAMS.

The south Atlantic coast and eastern Gulf of Mexico drainage basins include streams flowing into the Atlantic Ocean and Gulf of Mexico from York River, Va., to Pearl River, Miss., inclusive. The principal streams in this division are James, Roanoke, Cape Fear, Yadkin, Santee, Savannah, Altamaha, Apalachicola, Choctawhatchee, Mobile, and Pearl. The streams drain wholly or in part the States of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See pp. 29–30.)

GAGING STATIONS.[1]

Note.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinuance.

JAMES RIVER BASIN.

Jackson River (head of James) at Covington, Va., 1907–8.
James River at Buchanan, Va., 1895–
James River at Holcomb Rock, Va., 1900–
James River at Cartersville, Va., 1899–
Cowpasture River near Clifton Forge, Va., 1907–8.
James River, North Branch, near Glasgow, Va., 1895–1905.
Appomattox River at Mattoax, Va., 1900–1905.

ROANOKE RIVER BASIN.

Roanoke River at Roanoke, Va., 1896–
Roanoke River at Randolph, Va., 1900–1906.
Roanoke River above the Dan at Clarksville, Va., 1895–1898.
Roanoke River at Neal, N. C., 1896–1903.
Roanoke River near Thelma, N. C., 1912–
Roanoke River near Weldon, N. C., 1912–
Tinker Creek at Roanoke, Va., 1907–8.
Back Creek near Roanoke, Va., 1907–8.
Dan River at Madison, N. C., 1903–1908.
Dan River at South Boston, Va., 1900–1907.
Dan River at Clarksville, Va., 1895–1898.
Banister River at Houston, Va., 1904–5.

[1] York River, Va., to Pearl River, Miss.

TAR RIVER BASIN.

Tar River near Tarboro, N. C., 1896–1900.

NEUSE RIVER BASIN.

Neuse River near Selma, N. C., 1896–1900.

CAPE FEAR BASIN.

Haw River (head of Cape Fear River) near Moncure, N. C., 1898–9.
Cape Fear River near Fayetteville, N. C., 1889–1903.
Deep Creek near Cumnock, N. C., 1900–1902.
Deep Creek near Moncure, N. C., 1898–9.
Rockfish Creek near Brunt, N. C., 1902–3.

YADKIN RIVER BASIN.

Yadkin (or Peedee) River at North Wilkesboro, N. C., 1903–1909.
Yadkin River near Siloam, N. C., 1900–1901.
Yadkin River near Donnoha, N. C., 1913–
Yadkin River near Salisbury, N. C., 1895–
Yadkin River near Norwood, N. C., 1896–1899.
Yadkin River near Peedee, N. C., 1906–1912.
Peedee River at Cheraw, S. C., 1909–

SANTEE RIVER BASIN.

Catawba River (head of Santee River) at Old Fort, N. C., 1907.
Catawba River near Morganton, N. C., 1900–1909.
Catawba River near Catawba, N. C., 1896–1905.
Catawba River near Rockhill, S. C., 1895–1903.
Wateree River (lower part of Catawba) near Camden, S. C., 1904–1910.
Mill Creek at Old Fort, N. C., 1907.
Linnville River at Fonta Flora, N. C., 1907–8.
Linnville River near Bridgewater, N. C., 1900.
Johns River at Collettsville, N. C., 1907.
Johns River near Morganton, N. C., 1900–1901.
Broad River (of the Carolinas) (head of Congaree River) at Uree, N. C., 1907–1909.
Broad River (of the Carolinas) at Dellinger, S. C., 1900–1901.
Broad River (of the Carolinas) near Gaffney, S. C., 1896–1899.
Broad River (of the Carolinas) at Alston, S. C., 1896–1907.
Green River near Saluda, N. C., 1907–1909.
Second Broad River near Logans Store, N. C., 1907–8.
Saluda River near Waterloo, S. C., 1896–1905.
Saluda River near Ninety Six, S. C., 1905.

SAVANNAH RIVER BASIN.

Chattooga River (head of Savannah) near Clayton, Ga., 1907–8.
Tugaloo River (continuation of Chattooga River) near Toccoa, Ga., 1907–8.
Tugaloo River near Madison, S. C., 1898–1901; 1903–1910.
Savannah River near Calhoun Falls, S. C., 1896–1903.
Savannah River at Woodlawn, S. C., 1905–1910.
Savannah River at Augusta, Ga., 1899–1906.
Stekoa Creek near Clayton, Ga., 1907–8.
Tallulah River at Mathis, Ga., 1912–
Tallulah River at Tallulah Falls, Ga., 1900–1910; 1912.
Chauga River near Madison, S. C., 1907.
Seneca River near Clemson College, S. C., 1903–1905.

Savannah River tributaries—Continued.
Broad River (of Georgia) near Carlton, Ga., 1897–
Ogeechee River near Millen, Ga., 1903.
Williamsons Swamp Creek near Davisboro, Ga., 1903–4.
Cannoochee River near Groveland, Ga., 1903–1907.

ALTAMAHA RIVER BASIN.

South River (head of Ocmulgee River, which is head of Altamaha) near Lithonia, Ga., 1903–4.
Ocmulgee River near Jackson, Ga., 1906–
Ocmulgee River near Flovilla, Ga., 1901–1905.
Ocmulgee River at Macon, Ga., 1893–
Yellow River at Almon, Ga., 1897–1901.
Alcovy River near Covington, Ga., 1901–1904.
Alcovy River near Stewart, Ga., 1905–6.
Towaliga River near Juliette, Ga., 1899–1901.
Oconee River at Barnett Shoals, near Watkinsville, Ga., 1901–2.
Oconee River near Greensboro, Ga., 1903–
Oconee River at Carey, Ga., 1896–1898.
Oconee River at Fraleys Ferry, near Milledgeville, Ga., 1906–1908; 1909–
Oconee River at Milledgeville, Ga., 1903–1905.
Oconee River at Dublin, Ga., 1897–
Middle Oconee River near Athens, Ga., 1901–2.
Apalachee River near Buckhead Ga., 1901–1908.
Ohoopee River near Reidsville, Ga., 1903–1907.
Silver Springs River (head of St. John River) near Silver Springs, Fla., 1906.
North New River canal near Fort Lauderdale, Fla., 1913–
North New River canal near Rita, Fla., 1913–
South New River canal near Zona, Fla., 1913–
South New River canal near Rita, Fla., 1913–
Miami canal near Miami, Fla., 1913–

SUWANNEE RIVER BASIN.

Suwannee River near White Springs, Fla., 1906–1908.

APALACHICOLA RIVER BASIN.

Chattahoochee River (head of Apalachicola River) near Ariel, Ga., 1907–1909.
Chattahoochee River near Leaf, Ga., 1907.
Chattahoochee River near Gainesville, Ga., 1901–1903.
Chattahoochee River near Buford, Ga., 1901.
Chattahoochee River near Norcross, Ga., 1902–
Chattahoochee River near Oakdale, Ga., 1895–1904.
Chattahoochee River at West Point, Ga., 1896–
Chattahoochee River at Columbus, Ga., 1912–
Chattahoochee River at Alaga, Ala., 1908–
Soque River near Demorest, Ga., 1904–1909.
Sweetwater Creek near Austell, Ga., 1904–5.
Flint River near Molena, Ga., 1897–98.
Flint River near Woodbury, Ga., 1900–
Flint River near Mussela, Ga., 1907.
Flint River near Culloden, Ga., 1911–
Flint River near Montezuma, Ga., 1905–
Flint River at Albany, Ga., 1902–
Flint River at Bainbridge, Ga., 1908–

Chattahoochee River tributaries—Continued.
Chipola River at Altha, Fla., 1812.
Kinchafoonee Creek near Leesburg, Ga., 1905–1909.
Kinchafoonee Creek near Albany, Ga., 1903.
Muckalee Creek near Albany, Ga., 1903.
Ichawaynochaway Creek at Milford, Ga., 1905–1907.

CHOCTAWHATCHEE RIVER BASIN.

Choctawhatchee River near Newton, Ala., 1906–1908; 1912.
Choctawhatchee River near Geneva, Ala., 1904.
Double Bridge Creek at Geneva, Ala., 1904.
Pea River at Pera, Ala., 1904–1913.
Pea River at Elba, Ala., 1906.

ESCAMBIA RIVER BASIN.

Conecuh River at Beck, Ala., 1904–

MOBILE RIVER BASIN.

Cartecay River (head of Mobile River) near Cartecay, Ga., 1904–5; 1907.
Coosawattee River (continuation of Cartecay River) at Carters, Ga., 1896–1908.
Oostanaula River (continuation of Coosawattee River) at Resaca, Ga., 1896–
Coosa River (continuation of Oostanaula River) at Rome, Ga., 1897–1903.
Coosa River at Lock No. 4, Ala., above Riverside, Ala., 1890–1901.
Coosa River at Riverside, Ala., 1896–
Coosa River at Lock No. 5, near Riverside, Ala., 1892–1899.
Coosa River near Wetumpka, Ala., 1896–1898.
Alabama River (continuation of Coosa River) at Montgomery, Ala., 1899–1903.
Alabama River at Selma, Ala., 1900–
Ellijay River at Ellijay, Ga., 1907.
Conasauga River at Beaverdale, Ga., 1907–8.
Etowah River near Ball Ground, Ga., 1907–
Etowah River at Canton, Ga., 1892–1905.
Etowah River near Rome, Ga., 1904–
Etowah River at Rome, Ga., 1903.
Amicalola River near Potts Mountain, Ga., 1907–8; 1910–
Choccolocco Creek at Jenifer, Ala., 1903–1908.
Talladega Creek at Nottingham, Ala., 1900–1904.
Tallapoosa River at Sturdevant, Ala., 1900–
Tallapoosa River near Susanna, Ala., 1900–1901.
Tallapoosa River at Milstead, Ala., 1897–1903.
Hillabee Creek near Alexander City, Ala., 1900–1903.
Big Sandy Creek near Dadeville, Ala., 1900–1901.
Cahaba River at Centerville, Ala., 1901–1908.
Tombigbee River at Columbus, Miss., 1900–1910; 1912.
Tombigbee River at Epes, Ala., 1900–1901; 1904–1913.
Black Warrior River near Cordova, Ala., 1900–
Black Warrior River near Coal, Ala., 1908–1910.
Black Warrior River at Tuscaloosa, Ala., 1889–1905.
Clear Creek near Elk, Ala., 1904–5.
Locust Fork of Black Warrior River at Palos, Ala., 1901–1905.
Village Creek near Mulga., Ala., 1909–10.
Camp Branch near Ensley, Ala., 1908–1910.
Venison Branch near Mulga, Ala., 1908–9.

PEARL RIVER BASIN.

Pearl River at Jackson, Miss., 1901–
Bogue Chitto at Warnerton, La., 1906.

REPORTS ON WATER RESOURCES OF THE SOUTH ATLANTIC AND EASTERN GULF STATES.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distances along rivers of the United States, also brief descriptions of many of the streams, including Roanoke, Cape Fear, Pedee, Santee, Savannah, Oconee, Apalachicola, Chattahoochee, Coosa, Tallapoosa, and Black Warrior rivers.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

*62. Hydrography of the southern Appalachian Mountain region, Part I, by H. A. Pressey. 1902. 95 pp., 25 pls. 15c.

*63. Hydrography of the southern Appalachian Mountain region, Part II, by H. A. Pressey. 1902. 96–190 pp., pls. 26–44. 15c.

Nos. 62 and 63 describe in a general way the mountains, rivers, climate, forests, soil, vegetation, and mineral resources of the southern Appalachian Mountains, and then discuss in detail the drainage basins, giving for each an account of the physical features, rainfall, forests, minerals, transportation, discharge measurements, and water powers. Most of the streams described are tributary through Tennessee River to the Ohio, but Part II (No. 63) includes also descriptions of several streams in the south Atlantic and eastern Gulf of Mexico drainage basins.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Contains an account of flood on tributaries of Broad River (of the Carolinas) in Spartanburg County, S. C.

*102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on municipal water supplies, wells, and springs of Georgia, Alabama, and Mississippi. The reports comprise tabulated well records, giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

*107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp., 9 pls. 20c.

Contains gage heights, rating tables, estimates of monthly discharge at stations on Tallapoosa, Coosa, Alabama, Cahaba, Black Warrior, and Tombigbee rivers and their tributaries; gives estimates and short descriptions of water powers.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains reports as follows:

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie. Scope indicated by title.

Water resources of the Cowee and Pisgah quadrangles, North Carolina, by Hoyt S. Gale. Discusses drainage, springs, and mineral waters of one of the units of the geologic atlas of the United States.

*114. Underground waters of eastern United States; M. L. Fu
1905. 285 pp., 18 pls. 25c.

Contains brief reports relating to south Atlantic and eastern G
as follows:
North Carolina, by M. L. Fuller.
South Carolina, by L. C. Glenn.
Georgia, by S. W. McCallie.
Florida, by M. L. Fuller.
Alabama, by E. A. Smith.
Each of these reports describes the geology of the area in its rel
the principal mineral springs, and gives list of pertinent public ati

115. River surveys and profiles made during 1903, by W.
1905. 115 pp., 4 pls. 10c.

Contains results of surveys made to determine location of und
elevations and distances along Catawba, Tallulah, Chatooga,
Ocmulgee, Yellow, South, Alcovy, Towaliga, and Chattahoochee

*145. Contributions to the hydrology of eastern United Sta
geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains "Notes on certain hot springs of the southern United
Weed, including the "Warm springs of Georgia."
Describes the location of the springs, the geologic conditions, and
(with analyses); estimates discharge.

149. Preliminary list of deep borings in the United States, s
tions, by N. H. Darton. 1905. 175 pp. 10c.

Given by States (and within the States by counties), location,
of water, and other valuable information concerning wells 400 fe
all wells listed in Water-Supply Papers 57 and 61; mentions a
lating to deep borings.

159. Summary of the underground-water resources of Miss
and L. C. Johnson. 1906. 88 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the
depth of penetration, rate of percolation, and recovery of undergrou
and special conditions in the Coastal Plain formations; gives notes
records, and selected records in details; treats of sanitary aspect

*160. Underground-water papers, 1906; M. L. Fuller, geo
104 pp., 1 pl. 10c.

Contains brief report entitled "Peculiar mineral waters from
by Myron L. Fuller, discussing origin of certain mineral springs
analyses.

*162. Destructive floods in the United States in 1905, wi
discharge and frequency and an index to flood liter
and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates of flood discharge and frequency on Cape Fe
Black Warrior rivers; also index to literature on floods on Americ

319. Geology and underground waters of Florida, by George Charlton
Samuel Sanford. 1913. 444 pp., 17 pls.

Describes the characteristic upland, lowland, and coastal features of the State
lakes, caverns, sand dunes, coral reefs, bars, inlets, tidal runways, pine lands, s
and ocean currents; discusses in detail the stratigraphic position, lithologic cha
ness, physiographic expression, structure, and areal distribution of the geolog
treats of the source, amount, depth, circulation, and recovery of underground wate
waters and public water supplies; and gives details concerning source, quality, and
of the water supplies by counties. Discusses briefly the quality of the well water

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.
Annual reports are distributed free by the Geological Survey as long as its stock lasts.
indicates that this stock has been exhausted. Many of the papers so marked, however, may
from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

Tenth Annual Report of the United States Geological Survey, 1888–89, J.
Director. 1890. 2 parts. Pt. I. Geology, xv, 774 pp., 98 pls. $
tains:

General account of the fresh-water morasses of the United States, with a desc
Dismal Swamp district of Virginia and North Carolina, by N. S. Shaler, pp. 255
XIX. Scope indicated by title.

Fourteenth Annual Report of the United States Geological Survey, 189
Powell, Director. 1893. (Pt. II, 1894.) 2 parts. Pt. II. Acc
papers, xx, 597 pp., 73 pls. $2.10. Contains:

Potable waters of the eastern United States, by W J McGee, pp. 1 to 47. Di
water, stream waters, and ground waters, including mineral springs and artesian

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts.
indicates that this stock has been exhausted. Many of the papers marked with an aster
ever, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Profe
are of quarto size.

*37. The southern Appalachian forests, by H. B. Ayres and W. W. Ashe.
pp., 37 pls. 80c.

Describes the relief, drainage, climate, natural resources, scenery, and water
southern Appalachian forests, the trees, shrubs, and rate of growth; gives deta
forests by drainage basins, including New, Holston (southern tributaries of Sout
Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, Hiwassee, Tallu
Toxaway, Saluda and First and Second Broad rivers, Catawba and Yadkin rive
many of the tributaries of each of the master streams.

*72. Denudation and erosion in the southern Appalachian region and the M
basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, a
tion facilities of the region, the relation of agriculture, lumbering, mining, and p
ment to erosion and denudation, and the nature, effects, and remedies of erosion
of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwasse
along Tennessee River proper, and in the basins of the Coosa, Alabama system, C

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*138. Artesian-well prospects in the Atlantic Coastal Plain region, by N. H. Darton. 1896. 232 pp., 19 pls. 20c.

Describes the general geologic structure of the Atlantic Coastal Plain region and summarises the conditions affecting subterranean water in the Coastal Plain; discusses the general geologic relations in New York, southern New Jersey, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, and eastern Georgia; gives for each of the States a list of the deep wells and discusses well prospects. The notes on the wells that follow the tabulated lists contain many sections and analyses of the waters.

*264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records, to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Alabama, Florida, Georgia, and North Carolina, and detailed records of wells in Hancock and Jackson counties, Mississippi. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Virginia; and detailed records of wells in Madison, Marengo, and Mobile counties, Alabama; Duval, Escambia, Sumter, and Volusia counties, Florida; Chatham, Decatur, Fulton, Pierce, and Tattnall counties, Georgia; Lenoir, New Hanover, and Moore counties, North Carolina; Aiken, Barnwell, Charleston, Hampton, Lee, and Orangeburg counties, South Carolina; and Hancock, Harrison, Jackson, Marshall, Newton, and Panola counties, Mississippi. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

[1] Index maps showing areas in the South Atlantic States covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

80. Norfolk, Virginia-North Carolina, 1902. 5c.

Describes the plains, Dismal Swamp, and the tidal marshes; discusses the reclamation of swamp lands and gives an account of the underground waters; gives sections of wells near Norfolk and at Fort Monroe, and analyses of waters from the test boring at Norfolk and the boring at Lambert Point.

90. Cranberry, North Carolina-Tennessee. 5c.

Describes the geology and topography of an area in Carter and Johnson counties, Tenn., and Ashe, Watauga, Wilkes, Caldwell, and Mitchell counties, N. C., drained in part eastward into the Atlantic, in part southward into the Gulf of Mexico, and in part westward into the Mississippi. Under "Mineral resources" discusses water power.

124. Mount Mitchell, North Carolina. 5c.

Describes the topography and geology of an area whose waters pass through Tennessee River and the Ohio into the Mississippi, and through Catawba and Broad rivers directly to the Atlantic. Under "Economic geology" describes water powers and the various sources of water used for industrial and domestic supplies.

147. Pisgah, North Carolina-South Carolina. 5c.

Describes the topography and geology of an area drained in part by streams flowing to the Atlantic and in part by those flowing through Tennessee River into the Ohio and into the Mississippi. Under "Economic geology" discusses streams, water powers, and underground waters.

175. Birmingham, Alabama. 5c.

Describes the topography and geology of an area mainly in Jefferson and Blount Counties, but including small parts of Walker and Cullman Counties and St. Clair and Shelby Counties, drained almost wholly by Locust and Mulberry Forks of Black Warrior River and their tributaries. A small area in the southeastern part is drained by Cahaba River. Under "Economic geology" discusses underground water, surface water, and water power.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the South Atlantic States are the reports of the State surveys of North Carolina, Georgia, Florida, and Alabama, and the Tenth Census (vol. 16).

17368°—WSP 340—16——3

The following reports deserve special mention:

Hydrography of Virginia, by N. C. Grover and R. H. Bolster: Virginia Geol. Survey Bull. 3, 1906.

Underground waters of the Coastal Plain province of Virginia, by Samuel Sanford: Virginia Geol. Survey Bull. 5, 1913.

Water powers of Georgia, by B. M. Hall: Georgia Geol. Survey Bull. 3–A, 1896.

Artesian-well system of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 7, 1898.

Underground waters of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 15, 1908.

Water powers of Georgia, by B. M. Hall and M. R. Hall: Georgia Geol. Survey Bull. 16, 1908.

A preliminary report on the mineral springs of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 30, 1913.

A preliminary report on the underground water supply of central Florida, by E. H. Sellards: Florida Geol. Survey Bull. 1, 1908.

Underground waters of Mississippi; a preliminary report by W. N. Logan and W. R. Perkins: Mississippi Agr. Exper. Sta. Bull. 89, 1905.

Report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the Southern Appalachian region: 57th Congress, 1st sess., S. Doc. 84, 1902.

Water powers of North Carolina, a preliminary report, by Geo. F. Swain, J. A. Holmes, and E. W. Myers: North Carolina Geol. Survey Bull. 8, 1899.

Water powers of North Carolina, prepared by the hydrographic division of the U. S. Geological Survey: North Carolina Geol. Survey Bull. 20, 1911. (A supplement to Bull. 8.)

Many of these reports can be obtained by applying to the several organizations, and most of them can be consulted in the public libraries of the larger cities.

Part III. OHIO RIVER BASIN.

PRINCIPAL STREAMS.

The Ohio River basin includes Ohio River with all its tributaries, the most important being Allegheny, Monongahela, Beaver, Muskingum, New (or Kanawha), Scioto, Miami, Kentucky, Wabash, Cumberland, and Tennessee rivers. The streams drain wholly or in part the States of Alabama, Georgia, Illinois, Indiana, Kentucky, Mississippi, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the Ohio River basin, the following pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 41.)

GAGING STATIONS.

Note.—Dash following a date indicates that the station was being maintained June 30, 1913. Period after date indicates discontinuance.

Allegheny River (head of Ohio River) at Red House, N. Y., 1903–
Allegheny River at Kittanning, Pa., 1904–
- Conewango Creek:
  - Chautauqua Lake outlet (Chadakoin River) near Jamestown, N. Y., 1895.
  - Chadakoin River near Jamestown, N. Y., 1904–5.
- Kiskiminitas River at Avonmore, Pa., 1907–
- Kiskiminitas River at Salina, Pa., 1904–1906.
  - Blacklick Creek at Blacklick, Pa., 1904–
- Tygart River (head of Monongahela River) at Belington, W. Va., 1907–
- Tygart River at Fetterman, W. Va., 1907–
- Monongahela River at Lock No. 4, Pa., 1886–1906. Flood stage record only.
  - Buckhannon River at Hall, W. Va., 1907–
  - West Fork River at Enterprise, W. Va., 1907–
  - Elk Creek near Clarksburg, W. Va., 1913–
  - Buffalo Creek at Barrackville, W. Va., 1907–
  - Cheat River near Morgantown, W. Va., 1899–
  - Shavers Fork River at Parsons, W. Va., 1913–
  - Youghiogheny River at Friendsville, Md., 1898–1904.
  - Youghiogheny River at Confluence, Pa., 1904–
    - Casselman River at Confluence, Pa., 1904–
    - Laurel Hill Creek at Confluence, Pa., 1904–
    - Indian Creek in Westmoreland County, Pa., 1892–3.
- Beaver River:
  - Mahoning River at Youngstown, Ohio, 1903–1906.

Ohio River tributaries—Continued.
Cross Creek near Mingo Junction, Ohio, 1903.
McMahon River at Steel, Ohio, 1903.
Muskingum River at Zanesville, Ohio, 1905–
Mohican River at Pomerene, Ohio, 1910–
Licking River at Pleasant Valley, Ohio, 1902–1906.
Jonathan Creek at Powells, Ohio, 1902–3.
New River, South Fork (head of New River, which in turn is head of Kanawha River), at New River, N. C., 1900–01.
New River, South Fork, near Crumpler, N. C., 1908–
New River at Oldtown, Va., 1900–1903.
New River near Grayson, Va., 1908–
New River at Radford, Va., 1898–
New River at Fayette, W. Va., 1895–
New River, North Fork, at Weaversford, N. C., 1900–1901.
New River, North Fork, near Crumpler, N. C., 1908–
Reed Creek at Grahams Forge, Va., 1908–
Big Reed Island Creek near Allisonia, Va., 1908–
Little River near Copper Valley, Va., 1908–
Walker Creek at Staffordsville, Va., 1908–
Wolf Creek near Narrows, Va., 1908–
Bluestone River at Lilly, W. Va., 1908–
Bluestone River near True, W. Va., 1911–
Greenbrier River near Marlinton, W. Va., 1908–
Greenbrier River at Alderson, W. Va., 1895; 1908–
Gauley River at Allingdale, W. Va., 1908–
Gauley River near Summersville, W. Va., 1908–
Gauley River near Belva, W. Va., 1908–
Cherry River at Richwood, W. Va., 1908–
Meadow River near Russellville, W. Va., 1908–
Elk River at Webster Springs, 1908–
Elk River at Gassaway, W. Va., 1908–
Elk River at Clendennin, W. Va., 1908–
Coal River at Brushton, W. Va., 1908–
Coal River at Fuqua, W. Va., 1911–
Coal River at Tornado, W. Va., 1908–
Pocotaligo River at Sissonville, W. Va., 1908–
Mill Creek at Arlington Heights, Ohio, 1913–
Mill Creek at Cincinnati, Ohio, 1913–
Scioto River near Columbus, Ohio, 1898–1906.
Olentangy River near Columbus, Ohio, 1898–1905.
Little Miami River at Loveland, Ohio, 1906.
Little Miami River near Morrow, Ohio, 1903.
Miami River at Hamilton, Ohio, 1910–
Miami River at Dayton, Ohio, 1905–1910.
Mad River near Springfield, Ohio, 1904–1906.
Kentucky River at Frankfort, Ky., 1905–6.
Dix River near Danville, Ky., 1905.
Dix River near Burgin, Ky., 1910–
Salt River, Rolling Fork, at New Haven, Ky., 1905–6.
Wabash River at Logansport, Ind., 1903–1906.
Wabash River at La Fayette, Ind., 1901–1903.
Wabash River at Terre Haute, Ind., 1902–3 and 1905–6.

Ohio River tributaries—Continued.
Wabash River at Mount Carmel, Ill., 1884–
Tippecanoe River at Delphi, Ind., 1903–1908.
Embarrass River near Oakland, Ill., 1909–
Embarrass River at St. Marie, Ill., 1909–
White River, West Branch, at Indianapolis, Ind., 1904–1906.
Eel River at Cataract, Ind., 1903–1906.
White River, East Branch, at Shoals, Ind., 1903–
Little Wabash River near Clay City, Ill., 1909–
Little Wabash River near Golden Gate, Ill., 1909–
Little Wabash River at Carmi, Ill., 1909–
Skillet Fork near Wayne City, Ill., 1909–
Skillet Fork near Mill Shoals, Ill., 1909–
Cumberland River at Nashville, Tenn., 1901–1904.
French Broad River (head of Tennessee River) at Rosman, N. C., 1907–1909.
French Broad River at Horseshoe, N. C., 1904–1906.
French Broad River at Asheville, N. C., 1895–
French Broad River at Newport, Tenn., 1900–1907.
Tennessee River at Knoxville, Tenn., 1899–
Tennessee River at Chattanooga, Tenn., 1895–
Davidson River near Davidson, N. C., 1904–1909.
Little River at Calhoun, N. C., 1907–8.
Mills River, North Fork, at Pinkbed, N. C., 1904–1909.
Mills River, South Fork, near Sitton, N. C., 1904–1909.
Mud Creek at Naples, N. C., 1907.
Swannanoa River at Swannanoa, N. C., 1907–1909.
Swannanoa River at Biltmore, N. C., 1905.
Ivy River at Democrat, N. C., 1907.
Pigeon River at Canton, N. C., 1907–1909.
Pigeon River at Newport, Tenn., 1900–1909.
Nolichucky River at Chucky Valley, Tenn., 1900–1901.
Nolichucky River at Greeneville, Tenn., 1903–1908.
North Toe River at Spruce Pine, N. C., 1907–8.
Holston River, South Fork (head of Holston River), near Chilhowie, Va., 1907–1909.
Holston River, South Fork, at Bluff City, Tenn., 1900.
Holston River near Rogersville, Tenn., 1904–
Holston River, Middle Fork, at Chilhowie, Va., 1907–1910.
Watauga River at Butler, Tenn., 1900–1901.
Watauga River near Elizabethton, Tenn., 1903–1908.
Elk Creek at Lineback, Tenn., 1900–1901.
Roane Creek at Butler, Tenn., 1900–1901.
Doe River at Blevins, Tenn., 1911–
Doe River at Valley Forge, Tenn., 1913–
Doe River near Elizabethton, Tenn., 1907–
Holston River, North Fork, at Daltville, Va., 1907–8.
Little Tennessee River at Franklin, N. C., 1907–1910.
Little Tennessee River at Judson, N. C., 1896–
Little Tennessee River at McGhee, Tenn., 1905–
Cullasagee River at Cullasagee, N. C., 1907–1909.
Nantahala River near Nantahala, N. C., 1907–1909.
Tuckasegee River near East Laport, N. C., 1907–1909.

Ohio River tributaries—Continued.
Tennessee River tributaries—Continued.
Tuckasegee River at Bryson, N. C., 1896–
Scotts Creek near Dillsboro, N. C., 1907–8.
Oconalufty River near Cherokee, N. C., 1907–8.
Cheoah River at Millsaps, N. C., 1907–8.
Clinch River at Clinchport, Va., 1907–1909.
Hiwassee River near Hayesville, N. C., 1907–1909.
Hiwassee River at Murphy, N. C., 1907–
Hiwassee River at Reliance, Tenn., 1900–
Hiwassee River at Charlestown, Tenn., 1899–1903.
Tusquitee Creek near Hayesville, N. C., 1907–1909.
Valley River at Tomotla, N. C., 1904–1909.
Nottely River at Ranger, N. C., 1901–1905.
Toccoa River near Dial, Ga., 1907–8.
Toccoa River at Blueridge, Ga., 1899–1903.
Ocoee River at Copper Hill, Tenn., 1903–1910.
Elk Creek near Elkmont, Ala., 1904–1908.
Duck River at Columbia, Tenn., 1904–1908.

REPORTS ON WATER RESOURCES OF THE OHIO RIVER BASIN.[1]

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased from the SUPERINTENDNET OF DOCUMENTS, WASHINGTON, D. C. Water-supply Papers are of octavo size.

*21. Wells of northern Indiana, by Frank Leverett. 1899. 82 pp., 2 pls. (Continued in No. 26.)

Discusses by counties the glacial deposits and the sources of well waters; gives many well sections.

*24. Water resources of the State of New York, Part I, by G. W. Rafter. 1899. 99 pp., 13 pls.

*25. Water resources of the State of New York, Part II, by G. W. Rafter. 1899. 100 pp., 12 pls.

No. 24 contains descriptions of the principal rivers of New York and their more important tributaries, and data on temperature, precipitation, evaporation, and stream flow.

No. 25 contains discussion of water-storage projects on Genesee and Hudson rivers, power development at Niagara Falls, descriptions and early history of State canals, and a chapter on the use and value of the water power of the streams and canals; also brief discussion of the water yield of land areas of Long Island.

26. Wells of southern Indiana (continuation of No. 21), by Frank Leverett. 1899. 64 pp.

Discusses by counties the glacial deposits and the sources of well water; contains many well sections.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

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[1] For stream-measurement reports see tables on pages IV–VI.

62. Hydrography of the southern Appalachian Mountain region, Part I, by H. A. Pressey. 1902. 95 pp., 25 pls. 15c.

63. Hydrography of the southern Appalachian Mountain region, Part II, by H. A. Pressey. 1902. 96–190 pp., pls. 26–44. 15c.

Nos. 62 and 63 describe in a general way the mountains, rivers, climate, forests, soil, vegetation, and mineral resources of the southern Appalachian Mountains, and then discuss in detail the drainage basins, giving for each an account of the physical features, rainfall, forests, minerals, transportation, discharge measurements, and water powers. Most of the streams described are tributary through Tennessee River to the Ohio, but Part II (No. 63) includes also descriptions of several streams in the south Atlantic and eastern Gulf of Mexico drainage basins.

79. Normal and polluted waters in northeastern United States, by M. O. Leighton. 1903. 192 pp. 10c.

Defines essential qualities of water for various uses, the impurities in rain, surface, and underground waters, the meaning and importance of sanitary analyses, and the principal sources of pollution; chiefly "a review of the more readily available records" of examination of water supplies derived from streams in the Merrimac, Connecticut, Housatonic, Delaware, and Ohio River basins; contains many analyses.

91. The natural features and economic development of the Sandusky, Maumee, Muskingum, and Miami drainage areas in Ohio, by B. H. and M. S. Flynn. 1904. 130 pp. 10c.

Describes the topography, geology, and soils of the areas and discusses stream flow, dams, water powers, and public water supplies.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Contains notes on early floods in Mississippi Valley.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on springs and wells of Alabama, Georgia, Tennessee, and Kentucky. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp., 9 pls. 20c.

Contains gage heights, rating tables, estimates of monthly discharge at stations on Tallapoosa, Coosa, Alabama, Cahaba, Black Warrior, Tombigbee, and Tennessee rivers and their tributaries; gives estimates and short descriptions of water powers.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains reports as follows: Water resources of the Middlesboro-Harlan region of southeastern Kentucky, by George H. Ashley. Describes briefly the topographic features of the area and the water supply of Middlesboro and Pineville.

Water resources of the Cowee and Pisgah quadrangles, North Carolina, by Hoyt S. Gale. Discusses drainage, springs, and mineral waters of one of the units of the geologic atlas of the United States.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

Contains a brief report on the topography, drainage, geology, and the pollution of wells and streams by oil waste and brine in an area drained by Mississinewa River, a tributary of the Wabash.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports relating to Ohio River drainage areas, as follows:
Tennessee and Kentucky, by L. C. Glenn.
Ohio, by Frank Leverett.
Illinois, by Frank Leverett.
West Virginia, by M. L. Fuller.
Indiana, by Frank Leverett.
North Carolina, by M. L. Fuller.
South Carolina, by L. C. Glenn.
Georgia, by S. W. McCallie.
Alabama, by E. A. Smith.

Each of these reports describes the geology of the area in its relation to water supplies; notes the principal mineral springs, and gives list of pertinent publications.

115. River surveys and profiles made during 1903, by W. C. Hall and J. C. Hoyt. 1905. 115 pp., 4 pls. 10c.

Contains results of surveys made to determine location of undeveloped power sites. Gives elevations and distances along Hiwassee, Nottely, and Toccoa rivers.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains "Water resources of the Nicholas quadrangle, West Virginia," by George H. Ashley. Describes topography, geology, and domestic water supply of the hilly region in central West Virginia, a little east of New and Kanawha rivers.

147. Destructive floods in United States in 1904, by E. C. Murphy. 15c.

Contains "Wabash River flood, Indiana," by F. W. Hanna. Describes causes of flood, discharge, damage, and prevention of damage; also the drought in the Ohio River basin, its causes and effects; flood in Scottdale Valley, caused by failure of dam on Jacobs Creek (tributary to the Ohio through Youghiogheny River).

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other valuable information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

159. Summary of the underground-water resources of Mississippi, by A. F. Crider and L. C. Johnson. 1906. 88 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the State; discusses the source, depth of penetration, rate of percolation, and recovery of underground waters; artesian requisites, and special conditions in the Coastal Plain formations; gives notes on wells by counties, deep well records, and selected records in details; treats of sanitary aspect of wells and gives analyses.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives accounts of floods on Allegheny and Ohio rivers, and estimates of flood discharge and frequency on Monongahela, Youghiogheny, and Tennessee rivers; also index to literature on floods in American streams.

164. Underground waters of Tennessee and Kentucky west of Tennessee River and of an adjacent area in Illinois, by L. C. Glenn. 1906. 173 pp., 7 pls.

Describes static level and uses of waters, artesian conditions, and source properties of underground water; discusses topography, geology, and water resources by counties; gives logs of wells, analyses of waters, and bibliography of most important reports.

*197. Water resources of Georgia, by B. M. and M. R. Hall. 1907. 342 pp., 1 pl. 50c.

Describes topographic and geologic features of the State; discusses by drainage basins stream flow, river surveys, and water powers.

233. Water resources of the Blue Grass region, Kentucky, by G. C. Matson, with a chapter on the quality of the waters, by Chase Palmer. 1909. 96 pp., 2 pls. 20c.

Describes the geologic formations, physiographic features, soils, and surface waters of the region; the source, conditions of occurrence, amount and recovery of the underground waters, collection and storage of rainwaters, municipal water supplies, and conditions in each county; discusses under "Quality" the industrial uses of the water, comparative hardness, and mineral and table waters; many analyses.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Allegheny, Cumberland, Kentucky, Miami, Wabash, and Tennessee rivers and some of their tributaries.

239. The quality of the surface waters of Illinois, by W. D. Collins. 1910. 94 pp., 3 pls. 10c.

Discusses the natural and economic features that determine the character of the streams; describes the larger drainage basins and the methods of collecting and analyzing the samples of water, and discusses each river in detail with reference to its source, course, and quality of water; includes short chapters on municipal supplies and industrial uses.

254. Ground waters of north-central Indiana, by S. R. Capps, with a chapter on the chemical character of the waters, by R. B. Dole. 1910. 279 pp., 7 pls. 40c.

Describes relief, drainage, vegetation, soils and crops, industrial development, geologic formations; sources, movements, occurrence, and volume of ground water; methods of well construction and lifting devices; discusses in detail for each country, surface features and drainage, geology and ground water, city, village, and rural supplies, and gives records of wells and analyses of waters. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effect of the constituents on waters for domestic and industrial and medicinal uses, methods of purification, chemical composition; many analyses and field assays.

*259. The underground waters of southwestern Ohio, by M. L. Fuller and F. G. Clapp, with a discussion of the chemical character of the waters, by R. B. Dole. 1912. 228 pp., 9 pls. 35c.

Describes the topography, climate, and geology of the region, the water-bearing formations, the source, mode of occurrence, and head of the waters, and municipal supplies; gives details by counties; discusses in supplement, under chemical character, method of analysis and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, or medicinal uses, methods of purification, chemical composition; many analyses and field assays. The matter in the supplement was also published in Water-Supply Paper 254 (The underground waters of north-central Indiana).

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 32 pls.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. Pt. II. Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*Potable waters of the eastern United States, by W. J. McGee, pp. 1 to 47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. Pt. II. Economic geology and hydrography, pp. xxv, 864, 113 pls. Contains:

*The water resources of Illinois, by Frank Leverett, pp. 695–849, Pls. CVIII to CXIII. Describes the physical features of the State, and the drainage basins, including Illinois, Des Plaines, Kankakee, Fox, Illinois-Vermilion, Spoon, Mackinaw, and Sangamon rivers, Macoupin Creek, Rock River, tributaries of the Mississippi in western Illinois, Kaskaskia, Big Muddy, and tributaries of the Wabash; discusses the rainfall and run-off, navigable waters and water powers, the wells supplying water for rural districts, and artesian wells; contains tabulated artesian well data and water analyses.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. Pt. IV, Hydrography, pp. x, 756, 102 pls. Contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419–560. pls. xxxiii to xxxvii. Describes the Wabash, Whitewater, Great Miami, Little Miami, Scioto, Hocking, Muskingum, and Beaver rivers and lesser tributaries of the Ohio in Indiana and Ohio, the streams discharging into Lake Erie and Lake Michigan, and streams flowing to the upper Mississippi through the Illinois; discusses shallow and drift wells, the flowing wells from the drift and deeper artesian wells, and gives records of wells at many of the cities; describes the mineral springs, and gives analyses of the waters; contains also tabulated lists of cities using surface waters for waterworks, and of cities and villages using shallow and deep well waters; discusses the source and quality of the city and village supplies; and gives precipitation tables for various points.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. Pt. IV, Hydrography, pp. viii, 814, 118 plates. Contains:

*The rock waters of Ohio, by Edward Orton, pp. 633–717, pls. lxxi to lxxiii. Describes the principal geological formations of Ohio and the waters from the different strata; discusses the flowing wells at various points and the artesian wells of pre-Glacial channels in Allen, Auglaize, and Mercer counties; discusses city and village supplies; gives analyses of waters from various formations.

MONOGRAPHS.

Monographs are of quarto size. They are not distributed free, but may be obtained from the Geological Survey or from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C., at the prices indicated. An asterisk (*) indicates that the Survey's stock of the paper is exhausted.

XLI. Glacial formations and drainage features of the Erie and Ohio basins, by Frank Leverett. 1902. 802 pp., 26 pls. $1.75.

Treats of an area extending westward from Genesee Valley in New York across northwestern Pennsylvania and Ohio, central and southern Indiana, and southward from Lakes Ontario and Erie to the vicinity of Allegheny and Ohio rivers.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

37. The southern Appalachian forests, by H. B. Ayres and W. W. Ashe. 1905. 291 pp., 37 pls. 80c.

Describes the relief, drainage, climate, natural resources, scenery, and water supply of the southern Appalachian forests, the trees, shrubs, and rate of growth; gives details concerning forests by drainage basins, including, New, Holston (southern tributaries of South Fork only), Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, Hiwassee, Tallulah-Chatooga, Toxaway, Saluda, and First and Second Broad rivers, Catawba and Yadkin rivers; describing many of the tributaries of each of the master streams.

72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general method of work; gives tabulated records of wells in Illinois, Indiana, New York, Ohio, Pennsylvania, Tennessee, West Virginia, and Kentucky, and detailed records of wells in Delaware and Jay counties, Ind.; Greene, Warren, and Washington counties, Pa.; and Kanawha, Ritchie, and Wetzel counties, W. Va. These records were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 p. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee,

Virginia, and West Virginia, and detailed records of wells in Crawford County, Ill.; Delaware, Martin, Randolph, and Vanderburg counties, Ind.; Hopkins and Metcalf counties, Ky.; Hocking, Noble, Tuscarawas, and Wayne counties, Ohio; Armstrong, Greene, Warren, and Washington counties, Pa.; and Cabell, Harrison, Marion, Monongalia, Wayne, and Wetzel counties, W. Va. The wells of which detailed records are given were selected because they afford definite stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. A discount of 40 per cent is allowed on an order for folios or for folios together with topographic maps amounting to $5 at the retail rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*16. Knoxville folio, Tennessee-North Carolina.

Describes the geography and geology of the area and, under "Mineral resources," the water supply.

[1] Index maps showing areas in the Ohio River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

67. Danville folio, Illinois-Indiana.

Describes the topography and geology of the area and, under "Mineral resources," discusses the shallow dug or open wells, the tubular wells, and the flowing wells; gives also tabulated data concerning depth, head, water-bearing bed, etc., of the wells in the quadrangle.

84. Ditney folio, Indiana.

Describes the drainage and relief of the area, the geologic formation, and geologic structure and history, and, under "Economic resources," briefly discusses the underground water supply.

90. Cranberry folio, North Carolina-Tennessee.

Describes the geology and topography of an area in Carter and Johnson counties, Tenn., and Ashe, Watauga, Wilkes, Caldwell, and Mitchell counties, N. C., drained in part eastward into the Atlantic, in part southward into the Gulf of Mexico, and in part westward into the Mississippi. Under "Mineral resources" discusses water power.

102. Indiana folio, Pennsylvania.

Describes the physiographic relations, relief, and drainage of the Indiana quadrangle, the stratigraphic and structural geology, and under "Mineral resources" the surface and underground waters; indicates promising localities for artesian water.

105. Patoka folio, Indiana-Illinois.

Describes the drainage and relief of the area, the stratigraphic and structural geography and the geologic history, and under "Mineral resources" the water supply of the streams, springs, wells, cisterns, and artificial ponds.

121. Waynesburg folio, Pennsylvania.

Describes the drainage and surface relief of the area, the geologic formations and the geologic history, and in connection with the discussion of the mineral resources gives an account of the surface and underground water supplies.

123. Elders Ridge folio, Pennsylvania.

Describes the topography and stratigraphic, structural, and historical geology of the Elders Ridge quadrangle, and under "Mineral resources" discusses briefly the water supplies.

124. Mount Mitchell folio, North Carolina.

Describes the topography and geology of an area whose waters pass through Tennessee River and the Ohio into the Mississippi, and through Catawba and Broad rivers directly to the Atlantic; under "Economic geology" describes water powers and the various sources of water used for industrial and domestic supplies.

144. Amity folio, Pennsylvania.

Describes the relief and drainage of the Amity quadrangle in southwestern Pennsylvania, the stratigraphic, structural, and historical geology, and under "Mineral resources" gives a brief discussion of the water supply of the town of Washington.

146. Rogersville folio, Pennsylvania.

Describes the relief and drainage of the quadrangle in the extreme southwestern corner of Pennsylvania—principally in Greene County; under "Mineral resources" treats briefly of the water supply.

147. Pisgah folio, North Carolina-South Carolina.

Describes the topography and geology of an area drained in part by streams flowing to the Atlantic and in part by those flowing through Tennessee River into the Ohio and into the Mississippi; under "Economic geology" discusses streams, water powers, and underground waters.

151. Roan Mountain folio, Tennessee-North Carolina.

Describes the quadrangle in Tennessee and North Carolina which includes Johnson City, Tenn., and Elizabethton, N. C., which is drained by tributaries of Tennessee River; describes the relief and the rivers, the stratigraphic and structural geology, and under "Economic geology" the streams and their water powers and the waters available for wells.

160. Accident-Grantsville folio, Maryland-Pennsylvania-West Virginia.

Describes the drainage, relief, and geology of two quadrangles lying chiefly in Garrett County, Md.; the waters of the Accident quadrangle pass north and west to rivers that join the Ohio; those of the Grantsville quadrangle are about equally divided between tributaries of the Ohio and Savage River and Georges Creek which flow into the Potomac; under "Mineral resources" the folio describes Youghiogheny and Casselman rivers, Savage River, and Georges Creek, and the spring waters; notes possibility of obtaining artesian water.

172. Warren folio,[1] Pennsylvania-New York.

Describes the topography, drainage, and geology of the Warren quadrangle in the basin of Allegheny River in northwestern Pennsylvania; under "Economic geology" describes briefly the streams, springs, and underground waters.

174. Johnstown folio,[1] Pennsylvania.

Describes the relief, drainage, and geology of the Johnstown quadrangle, which lies mostly in Cambria County, Pa., but covers also small parts of Somerset, West Moreland, and Indiana counties. Most of it is included in the valley of Conemaugh River and its tributaries; under "Economic geology" describes the city water supply at Johnstown and the water resources of the quadrangle in general.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the Ohio River basin are the reports of the Chief of Engineers, United States Army; the State geological surveys of Alabama, Illinois, Kentucky, North Carolina, Tennessee, and Virginia; the Illinois Water-Supply Commission and the Rivers and Lakes Commission of Illinois; the New York State Conservation Commission and State Water-Supply Commission; the Water-Supply Commission of Pennsylvania and the Pittsburgh Flood Commission; and the water-power report of the Tenth Census (vol. 17). The following reports deserve special mention:

The Mississippi and Ohio rivers, by Charles H. Ellet. 1853.

Report upon the physics and hydraulics of the Mississippi River, by A. A. Humphreys and H. L. Abbot. 1876.

Preliminary report on a part of the water powers of Alabama, by B. M. Hall: Alabama Geol. Survey Bull. 7, 1903.

The underground water resources of Alabama, by Eugene A. Smith: Alabama Geol. Survey Mon. 6, 1907.

Preliminary report on a part of the water powers of Georgia, compiled by B. M. Hall: Georgia Geol. Survey Bull. 3 A, 1896.

Preliminary report on the underground waters of Georgia, by S. W. McCallie: Georgia Geol. Survey Bull. 15, 1908.

The mineral content of Illinois waters, by Edward Bartow, J. A. Udden, S. W. Parr, and George T. Palmer: Illinois State Geol. Survey Bull. 10, 1909.

Chemical survey of the waters of Illinois, report for the years 1897–1902, by A. W. Palmer, with Geology of Illinois as related to its water supply, by Charles W. Rolfe: University of Illinois publications.

Chemical and biological survey of waters of Illinois, by Edward Bartow: University of Illinois publications 3, 6, 7, 1906–1909.

Report upon the prevention of overflow of Little Wabash and Skillet Fork rivers, by W. J. McEathron and L. L. Hidinger. Rivers and Lakes Commission, 1911.

[1] Issued in two editions. (See p. 39.) Specify which edition is wanted.

Papers on the water power of North Carolina, a preliminary report by George F. Swain: North Carolina Geol. Survey Bull. 8, 1899.

Report of the investigations into the purification of the Ohio River water for the improved water supply of the city of Cincinnati, Ohio; made for the board of trustees, commissioners of waterworks, Cincinnati, 1899.

Progress report on a plan of sewerage for the city of Cincinnati, 1912–13.

The mineral waters of Indiana, their location, origin, and character, by W. S. Blatchley: Indiana Dept. Geology and Nat. Res. Twenty-sixth Ann. Rept. 1901.

Report on the flow of Dix River as a source of water power, by August F. Foerste, and Supplementary report on Dix River, by August F. Foerste: Kentucky Geol. Survey Bull 21, 1912.

Underground waters of Mississippi, a preliminary report, by W. N. Logan and W. R. Perkins: Mississippi Agr. Exper. Sta. Bull. 89.

Hydrology of the State of New York, by George W. Rafter: New York State Mus. Bull. 85, 1905.

A report to the mayor and city council on flood prediction for the city of Columbus, Ohio, 1913.

Report of the filtration commission of the city of Pittsburgh, Pa., 1899.

The water powers of Tennessee, by J. A. Switzer, including a report on Doe River, by A. H. Horton: Tennessee Geol. Survey Bull. 17, 1914.

Hydrography of Virginia, by N. C. Grover and R. H. Bolster: Virginia Geol. Survey Bull. 3, 1906.

Report of the Secretary of Agriculture in relation to the forests, rivers, and mountains of the Southern Appalachian region: 57th Congress, 1st sess., S. Doc. 84, 1902.

Many of these reports can be obtained by applying to the several commissions, and most of them can be consulted in the public libraries of the larger cities.

Part IV. ST. LAWRENCE RIVER BASIN.

PRINCIPAL STREAMS.

The St. Lawrence River basin includes streams which drain into the Great Lakes and St. Lawrence River. The principal streams flowing into Lake Superior from the United States are St. Louis, Ontonagon, Dead, and Carp rivers. Streams flowing into Lake Michigan are Escanaba, Menominee, Iron, Peshtigo, Oconto, Fox, St. Joseph, and Grand rivers. Into Lake Erie flow Huron, St. Marys, Maumee, Sandusky, Black, and Cuyahoga rivers. Streams flowing into Lake Ontario are Genesee, Oswego, Salmon, and Black rivers. The St. Lawrence receives Oswegatchie, Raquette, Richelieu (the outlet of Lake Champlain), and St. Francis River, whose principal tributary, Clyde River, reaches it through Lake Memphremagog. The streams of this basin drain wholly or in part the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, this part contains a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See pp. 51–52.)

GAGING STATIONS.

Note.—Dash following a date indicates that station was being maintained June 30, 1913. Period after date indicates discontinuance.

Streams tributary to Lake Superior:

Brule River at mouth, Minn., 1911.
Devil Track River at mouth, Minn., 1911.
Cascade River at mouth, Minn., 1911.
Poplar River at mouth, Minn., 1911–
Beaver Bay river at Beaver Bay, Minn., 1911–
St. Louis River near Forbes, Minn., 1910.
St. Louis River near Cloquet, Minn., 1903.
St. Louis River near Thomson, Minn., 1909–
Whiteface River at Meadowlands, Minn., 1909–
Cloquet River at Independence, Minn., 1909–
Ontonagon River near Rockland, Mich., 1903.
Dead River near Negaunee, Mich., 1902–3.
Dead River at Forestville, Mich., 1898–1902.
Carp River near Marquette, Mich., 1902–3.

Streams tributary to Lake Michigan:
- Escanaba River near Escanaba, Mich., 1903–
- Menominee River near Iron Mountain, Mich., 1902–
- Menominee River at Lower Quinnesec Falls, Wis., 1898–99
- Menominee River at Koss, Mich., 1907–1909.
- Iron River at Riverton Mine, Mich., 1900–1905.
- Peshtigo River near Crivitz, Wis., 1906–1909.
- Peshtigo River at Crivitz, Wis., 1906.
- Oconto River near Gillett, Wis., 1906–1909.
- Oconto River at Stiles, Wis., 1906.
- Fox River at Omro, Wis., 1902–3.
- Fox River at Oshkosh, Wis., 1902.
- Fox River at Wrightston, Wis., 1902–3.
  - Wolf River at Keshena, Wis., 1907–1909; 1911–
  - Wolf River at White House Bridge, near Shawano, Wis., 1906–7.
  - Wolf River at Darrows Bridge, near Shawano, Wis., 1906.
  - Wolf River at Northport, Wis., 1905.
  - Wolf River at Winneconne, Wis., 1902–3.
    - Little Wolf River near Northport, Wis., 1907–1910.
    - West Branch of Wolf River at Neopit, Wis., 1911–
  - Fond du Lac River, East Branch, at Fond du Lac, Wis., 1903.
  - Fond du Lac River, West Branch, at Fond du Lac, Wis., 1903.
- St. Joseph River at Mendon, Mich., 1902–1905.
- St. Joseph River at Buchanan, Mich., 1901–1906.
  - Fawn River at White Pigeon, Mich., 1903–4.
- Kalamazoo River near Allegan, Mich., 1901–1908.
  - Reeds Springs near Albion, Mich., 1904–1906.
- Muskegon River at Newayo, Mich., 1901–1906.
- Grand River at North Lansing, Mich., 1901–1906.
- Grand River at Grand Rapids, Mich., 1901–
  - Red Cedar River at Agricultural College, Mich., 1902–3.
  - Crockery Creek at Slocums Grove, Mich., 1902–3.
- Manistee River near Sherman, Mich., 1903–
- Boardman River at Traverse City, Mich., 1903–4.

Streams tributary to Lake Huron:
- Thunder Bay river near Alpena, Mich., 1901–1908.
- Au Sable River at Bamfield, Mich., 1902–
- Rifle River near Sterling, Mich., 1905–1908.
- Rifle River at Omer, Mich., 1902–3.
- Shiawassee River (head of Saginaw River)—
  - Flint River at Flint, Mich., 1903–4.
  - Cass River at Frankenmuth, Mich., 1908–9.
  - Cass River at Bridgeport, Mich., 1908.
  - Tittabawassee River at Freeland, Mich., 1903–1911.

Streams tributary to Lake Erie:
- Huron River at Dover, Mich., 1904.
- Huron River at Dexter, Mich., 1904–
- Huron River at Geddes, Mich., 1904–
- Huron River at French Landing, Mich., 1904–5.
- Huron River at Flat Rock, Mich., 1904–
- St. Marys River at Fort Wayne, Ind., 1905–6.
- Maumee River near Sherwood, Ohio, 1903–1906.

Streams tributary to Lake Erie—Continued.
Maumee River near Waterville, Ohio, 1898–1901.
St. Joseph River at Fort Wayne, Ind., 1905–6.
Tiffin River near Defiance, Ohio, 1903–1906.
Auglaize River near Defiance, Ohio, 1903.
Ottawa River at Lima, Ohio, 1902–3.
Blanchard River at Ottawa, Ohio, 1902–3.
Sandusky River near Mexico, Ohio, 1898–1900.
Sandusky River at Fremont, Ohio, 1898–1901.
Black River near Elyria, Ohio, 1903–1906.
Cuyahoga River at Independence, Ohio, 1903–1906.
Cuyahoga River at Cleveland, Ohio, 1903.
Cattaraugus Creek near Versailles, N. Y., 1910–
Streams tributary to Lake Ontario:
Little Tonawanda Creek near Linden, N. Y., 1912.
Genesee River at St. Helena, N. Y., 1908–
Genesee River at Mount Morris, N. Y., 1903–1909.
Genesee River at Jones Bridge, near Mount Morris, N. Y., 1903–1906; 1908–
Genesee River at Rochester, N. Y., 1904–
Canaseraga Creek at Dansville, N. Y., 1910–1912.
Keshequa Creek near Sonyea, N. Y., 1910–1912.
Hemlock Lake at Hemlock, N. Y., 1894–1902.
Canadice Lake outlet near Hemlock, N. Y., 1903–
Honeoye Creek at East Rush, N. Y., 1903–1906.
Seneca River (head of Oswego River) at Baldwinsville, N. Y., 1898–1908.
Oswego River at Battle Island, N. Y., 1900–1906.
Oswego River at Oswego, N. Y., 1897–1901.
Seneca Lake at Geneva, N. Y., 1905–6.
Owasco outlet at Auburn, N. Y. (Oswego drainage), 1912–
Cayuga Lake at Ithaca, N. Y., 1905–1908.
Fall Creek near Ithaca, N. Y., 1908–9.
Skaneateles Lake at Skaneateles, N. Y., 1890–91.
Skaneateles Lake outlet at Willow Glen, N. Y., 1892–1909.
Skaneateles Lake outlet at Jordan, N. Y., 1890–1892.
Onondaga Lake outlet at Long Branch, N. Y., 1904.
Fish Creek, East Branch (through Oneida Lake, head of Oneida River), at Point Rock, N. Y., 1898–99.
Oneida River at Brewerton, N. Y., 1899.
Oneida River at Euclid, N. Y., 1902–1909.
Oneida Creek at Kenwood, N. Y., 1898–1900.
Oneida River at Caughdenoy, N. Y., 1911–
Fish Creek, West Branch, at McConnellsville, N. Y., 1898–1901.
Chittenango Creek at Chittenango, N. Y., 1901–1906.
Chittenango Creek at Bridgeport, N. Y., 1898–1901.
Salmon River at Stillwater Bridge, near Redfield, N. Y., 1911–
Salmon River at Pulaski, N. Y., 1901–1908; 1910–
Orwell Brook near Altmar, N. Y., 1911–
Black River near Boonville, N. Y., 1911–
Black River near Felts Mills, Watertown, N. Y., 1902–
Black River at Huntingtonville Dam, near Watertown, N. Y., 1897–1901.
Moose River at Moose River, N. Y., 1900–
Middle Branch of Moose River at Old Forge, N. Y., 1911–
Beaver River at Croghan, N. Y., 1901–1903.

Streams tributary to the St. Lawrence:
Oswegatchie River near Ogdensburg, N. Y., 1903–
Oswegatchie, East Branch, at Newton Falls, N. Y., 1912–
Raquette River at Raquette Falls, near Coreys, N. Y., 1908–
Raquette River at Piercefield, N. Y., 1908–
Raquette River at South Colton, N. Y., 1904.
Raquette River at Massena Springs, N. Y., 1903–
Bog River near Tupper Lake, N. Y., 1908–1912.
St. Regis River near Brasher Center, N. Y., 1910–
Deer River at Ironton, N. Y., 1912–
Chateaugay River near Chateaugay, N. Y., 1908.
Richelieu River at Fort Montgomery, N. Y., 1875–
Big Chazy River at Mooers, N. Y., 1908.
Saranac River at Saranac Lake, N. Y., 1902–3.
Saranac River at Plattsburg, N. Y., 1903–
Au Sable River near Au Sable Forks, N. Y., 1910–
Au Sable River at Keeseville, N. Y., 1904 and 1908.
Boquet River at Wellsboro, N. Y., 1904 and 1908.
Lake George outlet at Ticonderoga, N. Y., 1904–5.
Poultney River at Fairhaven, Vt., 1908.
Mettawee River at Whitehall, N. Y., 1908.
Otter Creek at Middlebury, Vt., 1903–1907.
East Creek near Rutland, Vt., 1911–
Lake Champlain at Burlington, Vt., 1907–1909; 1911–
Winooski River above Stevens Branch near Montpelier, Vt., 1909–1911.
Winooski River at Montpelier, Vt., 1909–
Winooski River at Richmond, Vt., 1903–1907; 1910.
Worcester Branch of Winooski River at Montpelier, Vt., 1909–
Dog River at Northfield, Vt., 1909–
Lamoille River near Hardwick, Vt., 1912–13.
Lamoille River near Morrisville, Vt., 1909–10.
Lamoille River at Johnson, Vt., 1911–
Lamoille River at West Milton, Vt., 1903.
Missisquoi River near Richford, Vt., 1909–
Missisquoi River at Swanton, Vt., 1903.
St. Francis River—
Clyde River at West Derby, Vt., 1909–

REPORTS ON WATER RESOURCES OF THE ST. LAWRENCE RIVER BASIN.[1]

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Water-Supply Papers are of octavo size.

*21. Wells of northern Indiana, by Frank Leverett. 1899. 82 pp., 2 pls. (Continued in No. 26.) 10c.
Discusses by counties the glacial deposits and the sources of well water; gives many well sections.

*24. Water resources of the State of New York, Part I, by G. W. Rafter. 1899. 99 pp., 13 pls.

[1] For stream measurement reports see tables on pp. IV, V, VI.

*25. Water resources of the State of New York, Part II, by G. W. Rafter. 1899. 100 pp., 12 pls.

No. 24 contains descriptions of the principal rivers of New York and their more important tributaries and data on temperature, precipitation, evaporation, and stream flow.

No. 25 contains discussion of water storage projects on Genesee and Hudson Rivers, power development at Niagara Falls, descriptions and early history of State canals, and a chapter on the use and value of the water powers of the streams and canals; also brief discussion of the water yield of land areas of Long Island.

*26. Wells of southern Indiana (continuation of No. 21), by Frank Leverett. 1899. 64 pp.

Discusses by counties the glacial deposits and the sources of well water; contains many well sections.

*30. Water resources of the Lower Peninsula of Michigan, by A. C. Lane. 1899. 97 pp., 7 pls.

Describes lake and river transportaion and navigation, water powers and domestic water supplies; discusses climate, topography, geology, and well waters; compares quality and quantity of waters.

*31. Lower Michigan mineral waters, by A. C. Lane. 1899. 97 pp. 4 pls. 10c.

Treats of economic value of mineral waters and discussion and classification of analyses; contains analyses of waters of Lake Superior and of smaller lakes and rivers and of well waters from various geologic formations; also sanitary condition of drinking waters.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

91. The natural features and economic development of the Sandusky, Maumee, Muskingum, and Miami drainage areas in Ohio, by B. H. and M. S. Flynn. 1904. 130 pp. 10c.

Describes the topography, geology, and soils of the areas and discusses stream flow, dams, water powers, and public water supplies.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains a brief report on wells and springs of lower Michigan. The report comprises tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:

Minnesota, by C. W. Hall; Wisconsin district, by Alfred R. Schultz; Lower Michigan; Illinois, by Frank Leverett; Indiana, by Frank Leverett; New York, by F. B. Weeks; Ohio, by Frank Leverett.

Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains three brief reports pertaining chiefly to areas in the St. Lawrence River basin.

Two unusual types of artesian flow, by Myron L. Fuller. Describes (1) artesian flows from uniform, unconfined sand on Long Island, N. Y., and in Michigan; and (2) flow from jointed upper portion of limestone and other rocks in southeastern Michigan.

145. Contributions to the hydrology of eastern United States, 1905—Continued.

Water resources of the Catatonk area, New York, by E. M. Kindle. Describes topography and geology of areas southeast of Finger Lake region, N. Y., including part of city of Ithaca; discusses briefly the artesian wells of Ithaca, the quality of the spring water at several small towns, and of the streams used for municipal supplies and for power.

A ground-water problem in southeastern Michigan, by Myron L. Fuller. Discusses causes of failure of wells in certain areas in southeastern Michigan in 1904 and the application of the conclusions to other regions.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 15c.

Describes flood on Grand River, Mich., (from report of R. E. Horton), discussing streams, precipitation, and temperature, discharge, damage, and prevention of future damage.

*149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties) the location, depth, diameter, yield, height of water, and other features of wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

*156. Water powers of northern Wisconsin, by L. S. Smith. 1906. 144 pp., 5 pls. 25c.

Describes by river systems, the drainage, geology, topography, rainfall, and run-off, water powers and dams.

*160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl. 10c.

Contains brief report entitled Flowing well districts in the eastern part of the northern peninsula of Michigan, by Frank Leverett.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Contains accounts of floods on Sixmile Creek and Cayuga Inlet, N. Y. (in 1857, 1901, and 1905), and on Grand River, Michigan, and estimate of flood discharge and frequency for Genesee River; gives index to literature on floods in American streams.

*182. Flowing wells and municipal water supplies in the southern portion of the southern peninsula of Michigan, by Frank Leverett and others. 1906. 292 pp., 5 pls. 50c.

*183. Flowing wells and municipal water supplies in the middle and northern portion of the southern peninsula of Michigan, by Frank Leverett and others. 1907. 393 pp., 5 pls. 50c.

Nos. 182 and 183 describe in general the geographic features, water-bearing formations, drainage, quality of water, and subterranean water temperature, and give details concerning water supplies by counties. The reports contain many analyses.

*193. The quality of surface waters in Minnesota, by R. B. Dole and F. F. Wesbrook. 1907. 171 pp., 7 pls. 25c.

Describes by river basins the topography, geology, and soils, the industrial and municipal pollution of the streams, and gives notes on the municipalities; contains many analyses.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Lake Superior and Lake Michigan, Kalamazoo and Grand rivers, Lake Huron, Lake Erie, Maumee River, and St. Lawrence and Oswegatchie rivers.

239. The quality of the surface waters of Illinois, by W. D. Collins. 1910. 94 pp., 3 pls. 10c.

Discusses the natural and economic features that determine the character of the streams, describes the larger drainage basins and the methods of collecting and analyzing the samples of water, and discusses each river in detail with reference to its source, course, and quality of water includes short chapters on municipal supplies and industrial uses.

254. Ground waters of north-central Indiana, by S. R. Capps, with a chapter on the chemical character of the waters, by R. B. Dole. 1910. 279 pp., 7 pls. 40c.

Describes relief, drainage, vegetation, soils and crops, industrial development, geologic formations; sources, movements, occurrence, and volume of ground water; methods of well construction and lifting devices; discusses in detail, for each county, surface features and drainage, geology, and ground water, city, village, and rural supplies, and gives records of wells and analyses of waters. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effect of the constituents on waters for domestic and industrial and medicinal uses, methods of purification, chemical composition; many analyses and field assays.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

Annual Reports 1 to 26 are royal octavo; later reports are octavo.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. Pt. II. Accompanying papers, pp. xx, 597, 73 pls. Contains:

*Potable waters of the eastern United States, by W J McGee, pp. 1 to 47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. Contains:

*The water resources of Illinois, by Frank Leverett, pp. 695–849, Pls. CVIII to CXIII. Describes the physical features of the State, and the drainage basins, including Illinois, Des Plaines, Kankakee, Fox, Illinois-Vermilion, Spoon, Mackinaw, and Sangamon rivers, Macoupin Creek, Rock River, tributaries of the Mississippi in western Illinois, Kaskaskia, Big Muddy, and tributaries of the Wabash; discusses the rainfall and run-off, navigable waters and water powers, the wells supplying water for rural districts, and artesian wells; contains tabulated artesian-well data and water analyses.

Eighteenth Annual Report, United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. 5 parts in 6 volumes. Pt. IV, hydrography, pp. x, 756, 102 plates, contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419–560, pls. xxxiii to xxxvii. Describes Wabash, Whitewater, Great Miami, Little Miami, Scioto, Hocking, Muskingum, and Beaver rivers and lesser tributaries of the Ohio in Indiana and Ohio, the streams discharging into Lake Erie and Lake Michigan, and streams flowing to the Upper Mississippi through the Illinois; discusses shallow and drift wells, the flowing wells from the drift and deeper artesian wells, and gives records of wells at many of the cities; describes the mineral springs, and gives analyses of the waters; contains also tabulated lists of cities using surface waters for waterworks, and of cities and villages using shallow and deep well waters; discusses the source and quality of the city and village supplies, and gives precipitation tables for various points.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 volumes and separate case for maps with Pt. V. Pt. IV, hydrography, contains:

*The rock waters of Ohio, by Edward Orton, pp. 633–717, pls. lxxi to lxxiii. Describes the principal geologic formations of Ohio and the waters from the different strata; discusses the flowing wells at various points and the artesian wells of the deep preglacial channels in Allen, Auglaize, and Mercer counties; discusses city and village supplies; gives analyses of waters from various formations.

MONOGRAPHS.

Monographs are of quarto size. They are not distributed free, but may be obtained from the Geological Survey or from the Superintendent of Documents at the prices given. An asterisk (*) indicates that the Survey's stock of the paper is exhausted. (See Finding lists, pp. 89, 118.)

XLI. Glacial formations and drainage features of the Erie and Ohio basins, by Frank Leverett. 1902. 802 pp., 26 pls. $1.75.

Treats of an area extending westward from Genesee Valley in New York across northwestern Pennsylvania and Ohio, central and southern Indiana, and southward from Lakes Ontario and Erie to Allegheny and Ohio rivers.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin, and detailed records of wells in Onondaga County, New York, and Hancock and Wood counties, Ohio. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin; and detailed records of wells in Cook County, Ill.; Erie County, N. Y.; Ottawa, Sandusky, and Summit counties, Ohio; and Manitowoc County, Wis. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

[1] Index maps showing areas in the St. Lawrence basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*81. Chicago, Illinois-Indiana.

Describes an area embracing not only the immediate site of the city but adjacent parts of Cook, Dupage, and Will counties, Ill.; discusses the relief and drainage of the area, and describes the geologic formations, and under "Mineral resources" gives an account of the water power, surface waters, and deep and shallow rock wells. It discusses the quality of the waters and gives analyses of waters from artesian wells; gives also a list of papers relating to the geology and paleontology of the area.

140. Milwaukee special, Wisconsin.

Describes the topography and the stratigraphic and historical geology of the area above the city of Milwaukee; under "Economic geology" discusses rainfall, water power, water supply of cities and villages, mineral springs, and artesian wells; gives analyses of spring waters and of artesian water in Milwaukee; also tabulated data concerning wells.

*155. Ann Arbor, Mich.

Describes an area drained by streams that flow either directly or indirectly to the west end of Lake Erie, and comprise a large part of Washtenaw County and small adjacent portions of Livingston, Oakland, Wayne, Monroe, and Lenawee counties, Mich. Discusses the streams and the present lakes, the lakes of the glacial period, and, under "Economic geology," the water resources, including the use of the rivers for power and of the underground waters, shallow and artesian, for city and village supplies; discusses the quality of the waters, and gives details by townships.

169. Watkins Glen, Catatonk Valley, New York.

Describes two quadrangles located near the center of the southern tier of counties in the State of New York; describes the rivers, which include tributaries of the Susquehanna and the St. Lawrence, the lakes and swamps; and, under "Economic geology," springs and shallow and deep wells; discusses also water supply at Ithaca.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the St. Lawrence River basin are the reports of the Chief of Engineers United States Army, the State Geological Survey of Illinois, the Illinois Water-Supply Commission, the Rivers and Lakes Commission of Illinois, the New York State Conservation Commission and State Water-Supply Commission, and the water-power report of the Tenth Census (vol. 16). The following reports deserve special mention:

The mineral content of Illinois waters, by Edward Bartow, J. A. Udden, S. W. Parr, and George T. Palmer: Illinois State Geol. Survey Bull. 10, 1909.

Chemical and biological survey of waters of Illinois, by Edward Bartow: Univ. Illinois Pubs. 3, 6, 7, 1906–1909.

Chemical survey of the waters of Illinois, report for the years 1897–1902, by A. W. Palmer, with report on geology of Illinois as related to its water supply, by Charles W. Rolfe: Univ. Illinois Pub.

Diversion of the waters of the Great Lakes by way of the Sanitary and Ship Canal of Chicago: A brief of the facts and issues, by Lyman E. Cooley, Chicago, 1913.

The State of Missouri *v.* The State of Illinois and the Sanitary district of Chicago, before Frank S. Bright, commissioner of the Supreme Court of the United States. 1904.

The mineral waters of Indiana, their location, origin, and character, by W. S. Blatchley: Indiana Dept. Geology and Nat. Res. Twenty-sixth Ann. Rept., 1901.

Report on the water resources investigation of Minnesota by the State Drainage Commission, 1910.

Hydrology of the State of New York, by George W. Rafter: New York State Mus. Bull. 85, 1905.

Many of these reports can be obtained from the various commissions, and probably all can be consulted in the public libraries of the larger cities.

Part V. HUDSON BAY AND UPPER MISSISSIPPI RIVER DRAINAGE BASINS.

PRINCIPAL STREAMS.

The Hudson Bay and upper Mississippi River basins include streams whose waters reach Hudson Bay and the Mississippi above its junction with the Ohio (except the Missouri). The principal streams flowing into Hudson Bay from the United States are St. Mary River, Red River, and Rainy River. The principal tributaries of the upper Mississippi are Crow Wing, Sauk, Crow, Rum, Minnesota, St. Croix, Chippewa, Zumbro, Black, Root, Wisconsin, Wapsipinicon, Rock, Iowa, Des Moines, Illinois, Fox, and Kaskaskia rivers. These streams drain wholly or in part the States of Illinois, Indiana, Iowa, Minnesota, Missouri, Montana, North Dakota, South Dakota, and Wisconsin.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See pp. 60–61.)

GAGING STATIONS.

Note.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinuance.

HUDSON BAY DRAINAGE BASIN.

St. Mary River near Babb (formerly dam site), Mont., 1902–1910.
St. Mary River below Swiftcurrent Creek, at Babb, Mont., 1901–2; 1910–
St. Mary River near Kimball, Canada, 1902–
  Swiftcurrent Creek near Babb (formerly Wetzel), Mont., 1902–1910.
  Swiftcurrent Creek at McDermott Lake, Mont., 1912–
  Swiftcurrent Creek at Sherburne Lake, Mont., 1912–
  Kennedy Creek near Babb (formerly Wetzel), Mont., 1903–1905.
Ottertail River near Fergus Falls, Minn., 1904–
Red River near Fergus Falls, Minn., 1909–10.
Red River at Fargo, N. Dak., 1901–
Red River at Grand Forks, N. Dak., 1901– (gage height record 1895–1901).
Red River at Emerson, Manitoba, 1900–1902.
  Pelican River near Fergus Falls, Minn., 1909–
  Sheyenne River at Haggart, N. Dak., 1902–1907.
  Wild Rice River at Twin Valley, Minn., 1909–
    Devils Lake near Devils Lake, N. Dak., 1901–1911.
  Red Lake River at Thief River Falls, Minn., 1909–
  Red Lake River at Crookston, Minn., 1901–
    Thief River near Thief River Falls, Minn., 1909–
    Clearwater River at Red Lake Falls, Minn., 1909–
    Two Rivers, South Branch, Halleck, Minn., 1911–

Red River tributaries—Continued.
Pembina River at Neche, N. Dak., 1903–
Roseau River, West Branch, near Malung, Minn., 1911–
Mouse River near Foxholm, N. Dak., 1904–1906.
Mouse River at Minot, N. Dak., 1903–
Des Lacs River at Foxholm, N. Dak., 1904–1906.
Rainy Lake near Rainier, Minn., 1910–
Rainy River at International Falls, Minn., 1909–
Little Fork of Rainy River at Little Fork, Minn., 1909–
Big Fork River at Big Falls, Minn., 1909–1912.
Big Fork River near Laurel, Minn., 1909.
Black River near Loman, Minn., 1909.
Kawishiwi River at Kawishiwi Falls, near Winton, Minn., 1912–
Vermilion River below Lake Vermilion near Tower, Minn., 1911–

UPPER MISSISSIPPI RIVER BASIN.

Mississippi River above Sandy River, Minn., 1895–
Mississippi River near Fort Ripley, Minn., 1909–10.
Mississippi River near Sauk Rapids, Minn., 1903–1906.
Mississippi River at Anoka, Minn., 1905–
Mississippi River at St. Paul, Minn., 1873–
Sandy River below Sandy Lake Reservoir, Minn., 1893–
Pine River below Pine River Reservoir, Minn., 1895–
Prairie River near Grand Rapids, Minn., 1909.
Crow Wing River at Nimrod, Minn., 1910–
Crow Wing River at Motley, Minn., 1909.
Crow Wing River at Pillager, Minn., 1903; 1909–1913.
Long Prairie River near Motley, Minn., 1909–
Sauk River near St. Cloud, Minn., 1909–
Elk River near Big Lake, Minn., 1911–
Crow River at Rockford River, Minn., 1909–
Crow River near Dayton, Minn., 1906.
Crow River, North Fork, near Rockford, Minn., 1909–10.
Crow River, South Fork, near Rockford, Minn., 1909–1912.
Rum River at Onamia, Minn., 1909–1912.
Rum River at Cambridge, Minn., 1909–
Rum River at St. Francis, Minn., 1903.
Rum River near Anoka, Minn., 1905–1909.
Minnesota River near Odessa, Minn., 1909–1913.
Minnesota River near Montevideo, Minn., 1909–
Minnesota River near Mankato, Minn., 1903–
Whetstone River near Big Stone, S. Dak., 1910–1912.
Lac qui Parle River at Lac qui Parle, Minn., 1910–
Chippewa River near Watson, Minn., 1909–
Redwood River near Redwood Falls, Minn., 1909–
Cottonwood River near New Ulm, Minn., 1909–
Blue Earth River at Rapidan Mills, Minn., 1909–10.
St. Croix River near St. Croix Falls, Wis., 1902–1911.
Kettle River near Sandstone, Minn., 1908–
Snake River at Mora, Minn., 1909–1913.
Snake River at Pine City, Minn., 1913–
Cannon River at Welch, Minn., 1909–
Chippewa River at Chippewa Falls, Wis., 1899–

Mississippi River tributaries—Continued.
Chippewa River near Eau Claire, Wis., 1902–1909.
Flambeau River near Ladysmith, Wis., 1903–1906.
Red Cedar River at Cedar Falls, Wis., 1909–
Red Cedar River at Menominee, Wis., 1907–8; 1913–
Zumbro River at Zumbro Falls, Minn., 1909–
South Fork of Zumbro River near Zumbro Falls, Minn., 1911–
Black River at Neillsville, Wis., 1905–1909.
Black River at Melrose, Wis., 1902–3.
Root River near Houston, Minn., 1909–
Root River, North Branch, near Lanesboro, Minn., 1910–
Wisconsin River near Rhinelander, Wis., 1905–
Wisconsin River at Merrill, Wis., 1902–
Wisconsin River near Necedah, Wis., 1902–
Wisconsin River at Muscoda, Wis., 1902–3.
Maquoketa River at Manchester, Iowa, 1903.
Wapsipinicon River at Stone City, Iowa, 1903–
Rock River above mouth of Pecatonica River at Rockton, Ill., 1903.
Rock River below mouth of Pecatonica River at Rockton, Ill., 1903–1909.
Rock River near Nelson, Ill., 1906.
Rock River at Sterling, Ill., 1905–6.
Catfish River at Madison, Wis., 1902–3.
Lake Mendota at Madison, Wis., 1902–3.
Iowa River near Iowa Falls, Iowa, 1911–
Iowa River at Marshalltown, Iowa, 1903.
Iowa River at Iowa City, Iowa, 1903–1906.
Cedar River near Austin, Minn., 1909–
Red Cedar River at Janesville, Iowa, 1905–6.
Cedar River at Cedar Rapids, Iowa, 1903–
Des Moines River at Jackson, Minn., 1909–
Des Moines River at Fort Dodge, Iowa, 1905–6; 1911–
Des Moines River at Des Moines, Iowa, 1902–3; 1905–6.
Des Moines River at Keosauqua, Iowa, 1903–1906; 1911–
Raccoon River near Des Moines, Iowa, 1902–3.
Illinois River near Minoka, Ill., 1903–4.
Illinois River near Seneca, Ill., 1903.
Illinois River near Ottawa, Ill., 1903–4.
Illinois River near La Salle, 1903.
Illinois River near Peoria, Ill., 1903–1906.
Kankakee River at Davis, Ind., 1905–6.
Kankakee River at Momence, Ill., 1905–6.
Yellow River at Knox, Ind., 1905–6.
Desplaines River above mouth of Jackson Creek near Channahon, Ill., 1903–1906.
Desplaines River above Kankakee River, near Channahon, Ill., 1902–3.
Fox River at Sheridan, Ill., 1905–6.
Fox River at Ottawa, Ill., 1903.
Sangamon River at Monticello, Ill., 1908–1912.
Sangamon River at Decatur, Ill., 1905.
Sangamon River at Riverton, Ill., 1908–1912.
Sangamon River at Springfield, Ill., 1903.
Sangamon River near Oakford, Ill., 1909–1912.
Sangamon River near Chandlerville, Ill., 1908.
Sangamon River, South Fork, near Taylorville, Ill., 1908–1912.
Salt Creek near Kenny, Ill., 1908–1912.

Mississippi River, tributaries—Continued.
Cahokia Creek near Poag, Ill., 1909–1912.
Kaskaskia River near Arcola, Ill., 1908–1912.
Kaskaskia River at Shelbyville, Ill., 1908–1912.
Kaskaskia River at Vandalia, Ill., 1908–1912.
Kaskaskia River at Carlysle, Ill., 1908–1912.
Kaskaskia River at New Athens, Ill., 1909–1912.
Shoal Creek near Breese, Ill., 1909–1912.
Silver Creek near Lebanon, Ill., 1908–1912.
Big Muddy River near Cambon, Ill., 1908–1912.
Beaucoup Creek near Pinckneyville, Ill., 1908–1913.

REPORTS ON WATER RESOURCES OF THE HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS.

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at prices noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp. 13 pls. 15c.

Contains notes on early floods in Mississippi Valley.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on wells and springs of Minnesota and Missouri.

The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, material penetrated, temperature, use, and quality; many miscellaneous analyses.

114. Underground waters of eastern United States: M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:
Missouri, by E. M. Shepard.
Iowa, by W. H. Norton.
Minnesota, by C. W. Hall.
Wisconsin district, by Alfred R. Schultz.
Illinois, by Frank Leverett.
Indiana, by Frank Leverett.

Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.

Contains two reports relating to areas draining to Hudson Bay or upper Mississippi River:

Water resources of Mineral Point quadrangle, Wisconsin, by U. S. Grant. Describes springs, streams, and shallow and deep wells.

Water supplies at Waterloo, Iowa, by W. H. Norton. Summarizes results of investigations to determine availability of artesian water to replace the surface supply from Cedar River; discusses necessity of test wells, supplementary supplies, artesian head, and permanency of flow.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Given by States (and within the States by counties), the location, depth, diameter, yield, height of water, and other features of wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*156. Water powers of northern Wisconsin, by L. S. Smith. 1906. 144 pp., 5 pls.

Describes by river systems the drainage, geology, topography, rainfall, and run-off, water powers, and dams.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index of flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls.

Contains accounts of floods in southeastern Minnesota, on Devils Creek, Iowa, and in Des Moines County, Iowa; gives estimates of flood discharge and frequency on Illinois River and on Mississippi River at St. Paul; gives also index to literature on floods on American streams

*193. The quality of surface waters in Minnesota, by R. B. Dole and F. F. Wesbrook. 1907. 171 pp., 7 pls.

Describes by river basins the topography, geology, and soils, the industrial and municipal pollution of the streams, and gives notes on the municipalities; contains many analyses.

*194. Pollution of Illinois and Mississippi Rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls.

Scope indicated by amplification of title.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties, gives statistics of city water supplies, analyses of waters, and many well records.

*227. Geology and underground waters of South Dakota, by N. H. Darton. 1909. 156 pp., 15 pls.

Describes physical features, geologic formations, water horizons, and, by counties, deep wells and well prospects; gives notes on construction and management of artesian wells.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Mississippi Minnesota, Chippewa, Wisconsin, Rock, Iowa, Cedar, Des Moines, Illinois, Kankakee, Fox, Sangamon, Kaskaskia, and Big Muddy rivers.

239. The quality of the surface waters of Illinois, by W. D. Collins. 1910. 94 pp., 3 pls.

Discusses the natural and economic features that determine the character of the streams, describes the larger drainage basins, and the methods of collecting and analyzing the samples of water, and discusses each river in detail with reference to its source and course and the quality of water; includes short chapters on municipal supplies and industrial uses.

254. The underground waters of north-central Indiana, by S. R. Capps, with a chapter on the chemical character of the waters, by R. B. Dole. 1910. 279 pp., 7 pls.

Describes relief, drainage, vegetation, soils, and crops, industrial development, geologic formations; sources, movements, occurrence, and volume of ground water; methods of well construction and lifting devices; discusses in detail for each county, surface features and drainage, geology and ground water, city, village, and rural supplies, and gives records of wells and analyses of waters. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effect of the constituents on waters for domestic and industrial and medicinal uses, methods of purification, chemical composition; many analyses and field assays.

256. Geology and underground waters of southern Minnesota, by C. W. Hall, O. E, Meinzer, and M. L. Fuller. 1911. 406 pp., 18 pls.

Discusses the physiography of the State, geologic formations and their water-bearing capacity, artesian conditions, the mineral quality of the underground waters, types of wells, finishing wells in sand, drilling in quartzite, fluctuation in yield and head, "blowing" and "breathing" wells; freezing of wells, drainage by wells, hydraulic rains, and scientific prospecting for water, municipal supplies; power; storage and distribution; consumption of water; prices; sanitation. Gives by counties details concerning surface features, rocks, yield, head, and quality of water, and summaries and analyses.

293. Underground water resources of Iowa, by W. H. Norton, W. S. Hendrixson. H. E. Simpson, O. E. Meinzer, and others. 1912. 994 pp., 18 pls.

Describes the relief, drainage, temperature, and precipitation of the State and the geologic formations; discusses the geologic occurrence of underground waters, artesian phenomena and and yield of artesian wells, the chemical composition of underground waters, municipal, domestic and industrial water supplies, and mineral waters; gives details concerning topography, geology, underground waters, and city and village supplies by districts and counties.

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*Sixteenth Annual Report of the United States Geological Survey, 1894–95. 4 parts. Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. Contains:

*The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV to XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director, 1896: 3 parts in 4 vols. Pt. II. Economic geology and hydrography, pp. xxv, 864, 113 Pls. Contains:

Preliminary report on artesian waters of a portion of the Dakotas, by N. H. Darton, pp. 603–694, Pls. lxix to cvii. Gives an outline of the geologic relations; describes the water horizons and the extent of the artesian water, and gives details concerning wells and prospects by counties; discusses the origin, amount, pressure, head, and composition of the artesian waters, the use of artesian water for power, and gives details concerning artesian irrigation by counties; contains also remarks on the construction and management of artesian wells.

*The water resources of Illinois, by Frank Leverett, pp. 695–849, Pls. cviii to cxiii. Describes the physical features of the State, and the drainage basins, including Illinois, Des Plaines, Kankakee, Fox, Illinois-Vermilion, Spoon, Mackinaw, and Sangamon rivers, Macoupin Creek, Rock River, tributaries of the Mississippi in western Illinois, Kaskaskia, Big Muddy, and tributaries of the Wabash; discusses the rainfall and run-off, navigable waters and water powers, the wells supplying water for rural districts, and artesian wells; contains tabulated artesian well data and water analyses.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, 5 parts in 6 vols., Pt. IV, Hydrography, pp. x, 756, 102 pls. Contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419–560, pls. xxxiii to xxxvii. Describes the Wabash, Whitewater, Great Miami, Little Miami, Scioto, Hocking, Muskingum, and Beaver rivers, streams and lesser tributaries of the Ohio in Indiana and Ohio, the streams discharging into Lake Erie and Lake Michigan, and streams flowing to the upper Mississippi through the Illinois; discusses shallow and drift wells, the flowing wells from the drift and deeper artesian wells, and gives records of wells at many of the cities; describes the mineral springs, and gives analyses of the waters; contains also tabulated lists of cities using surface waters for waterworks, and of cities and villages using shallow and deep well waters; discusses the source and quality of the city and village supplies; and gives precipitation tables for various points.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Illinois and Iowa, and detailed records of wells in Boone, Dupage, Henry, and La Salle counties, Ill., and Des Moines and Scott counties, Iowa. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Illinois, Indiana, Iowa, Minnesota, Missouri, North Dakota, South Dakota, and Wisconsin; and detailed records of wells in Brown, Hancock, La Salle, Pike, and Schuyler counties, Ill.; Blackhawk, Floyd, Louisa, Mahaska, Scott, and Wapello counties, Iowa; and Hennepin, Ottertail, and Pine counties, Minn. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an

[1] Index maps showing areas in the Hudson Bay and Upper Mississippi River basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

117. Casselton-Fargo, North Dakota-Minnesota.

Describes an area representing a typical section across the so-called valley of Red River, including a small extent of prairie upland on the west; discusses the relief of the area; describes the principal rivers, gives an account of the general geology, including a brief history of Lake Agassiz, and under "Economic geology" gives a somewhat detailed account of the water supply, including descriptions and logs of principal wells and tabulated well records; contains artesian water maps showing areas which will probably yield flowing wells.

*145. Lancaster—Mineral Point, Wisconsin-Iowa-Illinois.

Describes the relief and drainage of the Lancaster and Mineral Point quadrangles and the stratigraphic, structural, and historical geology; under "Economic geology" discusses the springs, shallow and deep wells, streams and water power; gives analyses of artesian water from well at Dubuque, Iowa.

168. Jamestown-Tower (Jamestown, Eckelson, and Tower quadrangles), North Dakota.

Describes an area in eastern North Dakota, including a portion of Cass, Barnes, Stutsman, Ransom, and Lamoure counties, drained in part by streams that ultimately discharge into Hudson Bay and in part by streams that finally reach the Gulf of Mexico; describes the relief, drainage, and geology of the area, and, under "Economic geology," shallow, deep, and artesian wells; discusses head, pressure, power, volume, and character of the water, and gives a tabulated list of representative wells; contains an artesian water map showing areas in which flowing wells may probably be obtained.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the Hudson Bay and upper Mississippi River basins are the reports of the State surveys of Illinois and North Dakota, the Illinois Water-Supply Commission, and the Rivers and Lakes Commission of Illinois, and the water-power report of the Tenth Census (vol. 17). The following reports deserve special mention:

Contributions to the physical geography of the United States, Part I, On the physical geography of the Mississippi Valley, with suggestions for the improvement of navigation of the Ohio and other rivers, by Charles Ellet, jr.: Smithsonian Pub. 13, Washington, 1850.

The Mississippi and Ohio rivers, by Charles H. Ellet. 1853.

Report upon the physics and hydraulics of the Mississippi River, by A. A. Humphreys and H. L. Abbott, 1876.

The mineral content of Illinois waters, by Edward Bartow, J. A. Udden, S. W. Parr, and George T. Palmer: Illinois State Geol. Survey Bull. 10, 1909.

Water resources of the East St. Louis district, by Isaiah Bowman: Illinois State Geol. Survey Bull. 5, 1907.

Chemical and biological survey of waters of Illinois, by Edward Bartow: Univ. Illinois Pub. 3, 6, 7, 1906–1909.

Chemical survey of the waters of Illinois, report for the years 1897–1902, by A. W. Palmer, with report on Geology of Illinois as related to its water supply, by Charles W. Rolfe: Univ. Illinois Pub.

Report and plans for the reclamation of lands subject to overflow in the Kaskaskia River Valley, Illinois; begun under the direction of the Internal Improvement Commission; completed and published under the direction of the Rivers and Lakes Commission of Illinois, by Jacob A. Harmon. 1912.

Diversion of the waters of the Great Lakes by way of the sanitary and ship canal of Chicago: A brief of the facts and issues, by Lyman E. Cooley, Chicago, 1913.

The State of Missouri *vs.* the State of Illinois and the Sanitary district of Chicago, before Frank S. Bright, Commissioner of the Supreme Court of the United States. 1904.

The mineral waters of Indiana, their location, origin, and character, by W. S. Blatchley: Indiana Dept. Geology and Nat. Res. Twenty-sixth Ann. Rept., 1901.

Report on the water resourses investigation of Minnesota by the State Drainage Commission, 1910.

Report of the commission on conservation [Montana] on bills relating to the public lands, water rights, and the protection and preservation of the forests, 1911.

Governor's message relating to conservation [in Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests.

Water resources of the Devils Lake region, North Dakota, by E. J. Babcock: North Dakota Geol. Survey, Second Bienn. Rept., 1903.

Many of these reports can be obtained by applying to the several organizations, and most of them can be consulted in the public libraries of the larger cities.

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Part VI. MISSOURI RIVER BASIN.

PRINCIPAL STREAMS.

The principal streams in the Missouri River basin are Red Rock, Beaverhead, and Jefferson rivers, which may be considered a continuous river forming the head of the Missouri; and, below the mouth of the Jefferson, Madison, Gallatin, Prickly Pear, Little Prickly Pear, Dearborn, Sun, Marias, Judith, Musselshell, Milk, Yellowstone, Little Muddy, Little Missouri, Cheyenne, Niobrara, Platte (including North Platte and South Platte), Kansas, Osage (Marais des Cygnes), and Gasconade rivers. These streams drain wholly or in part the States of Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See pp. 80–81.)

GAGING STATIONS.

Note.—Dash after a date indicates that station was being maintained June 30, 1913; period after a date indicates discontinuance.

Red Rock River (head of Missouri) above Red Rock reservoir, near Monida, Mont., 1911.
Red Rock River below Red Rock reservoir, near Monida, Mont., 1911–
Red Rock River at Lima, Mont., 1907–1911.
Red Rock River at Red Rock, Mont., 1890.
Beaverhead River (continuation of Red Rock River) at Barratts, Mont., 1907–
Beaverhead River at Dillon, Mont., 1907.
Jefferson River (continuation of Red Rock-Beaverhead River) near Sappington, Mont., 1894–95.
Jefferson River near Silverstar, Mont., 1910–
Missouri River near Townsend, Mont., 1891–1904.
Missouri River at Canyon Ferry, Mont., 1889.
Missouri River near Craig, Mont., 1890–1892.
Missouri River at Toston, Mont., 1890; 1910–
Missouri River at Cascade, Mont., 1902–
Missouri River at Great Falls, Mont., 1897–1905.
Missouri River at Fort Benton, Mont., 1910–
Missouri River near Williston, N. Dak., 1905–1907.
Missouri River at Mannhaven, N. Dak., 1904–1905.
Missouri River at Washburn, N. Dak., 1904; 1905.
Missouri River at Bismarck, N. Dak., 1904–5.
Missouri River near Nesson, N. Dak., 1904–5.

Missouri River at Kansas City, Mo., 1905–6.
Passamari River [Ruby River] near Alder, Mont., 1911–
Bighole River near Dewey, Mont., 1910–
Pipestone Creek near Whitehall, Mont., 1910–11.
Whitetail Creek near Whitehall, Mont., 1910–11.
Little Whitetail Creek near Whitehall, Mont., 1911.
Boulder Creek:
Muskrat Creek near Boulder, Mont., 1912–
Gibbon River (head of Madison River) near Yellowstone, Mont., 1913–
Madison River near Yellowstone, Mont., 1913–
Madison River near Red Bluff, Mont., 1890–1894.
Madison River near Norris, Mont., 1897–1905; 1910.
Madison River near Three Forks, Mont., 1893–1897.
West Gallatin River (head of Gallatin River) near Salesville, Mont., 1895–1905; 1910–
West Gallatin River near Bozeman, Mont., 1889–1894.
Gallatin River at Logan, Mont., 1893–1905.
Middle Creek near Bozeman, Mont., 1895–96; 1898–1900; 1902–3.
Crow Creek near Radersburg, Mont., 1901.
Crow Creek near Townsend, Mont., 1912–
Deep Creek near Townsend, Mont., 1910–
Prickly Pear Creek near Clancy, Mont., 1908–
Prickly Pear Creek at East Helena, Mont., 1908–
Lump Gulch Creek near Clancy, Mont., 1908–
Tenmile Creek near Helena, Mont., 1908–
Sevenmile Creek at Birdseye, Mont., 1908–
Little Prickly Pear Creek near Marysville, Mont., 1909–
Little Prickly Pear Creek near Canyon Creek, Mont., 1909–1912; 1913–
Deadman Creek near Marysville, Mont., 1909–1911.
Lost Horse Creek near Marysville, Mont., 1909–1911.
Marsh Creek near Marysville, Mont., 1909–1911.
Dearborn River near Clemons, Mont., 1908–1911.
Falls Creek near Clemons, Mont., 1908–1911.
Smith River at Truly, Mont., 1905–1907.
Sun River, North Fork of North Fork (head of Sun River), near Augusta, Mont., 1911–12.
Sun River, North Fork, near Augusta, Mont., 1889–90; 1903–
Sun River at Fort Shaw, Mont., 1912–
Sun River at Sun River, Mont., 1905–1912.
Sun River near Great Falls, Mont., 1897.
South Fork of North Fork of Sun River near Augusta, Mont., 1911–12.
Willow Creek near Augusta, Mont., 1905–1911; 1912–
South Fork of Sun River at Augusta, Mont., 1904–
Ford Creek near Augusta, Mont., 1906–1912.
Smith Creek near Augusta, Mont., 1906–1912.
Sun River canals:
Floweree Big canal near Fort Shaw, Mont., 1912.
Crown Butte canal at Riebling, Mont., 1912.
Crown Butte canal near Simms, Mont., 1912.
Sun River canal near Sun River, Mont., 1912.
Sun River canal at Vaughan, Mont., 1912.
Belt Creek near Belt, Mont., 1905–6.
Highwood Creek near Highwood, Mont., 1905–6.
Marias River near Shelby, Mont., 1902–1906; 1911–
Two Medicine River near Midvale, Mont., 1902–3.

Missouri River tributaries—Continued.
Marias River tributaries—Continued.
Two Medicine River at Family, Mont., 1907–
Badger Creek near Family, Mont., 1907–
Cut Bank Creek at Cut Bank, Mont., 1905–
Birch Creek at Swift dam, near Dupuyer, Mont., 1913–
Birch Creek near Dupuyer, Mont., 1907–
Birch Creek at Hall's ranch, near Dupuyer, Mont., 1913–
Dupuyer Creek at Dupuyer, Mont., 1908–12.
Dupuyer Creek near Valier, Mont., 1912–
Dry Fork of Marias River near Valier, Mont., 1911–
Teton River at Strabane [near Belleview], Mont., 1904–6; 1908–
Teton River at Chouteau, Mont., 1904–1906; 1913–
Deep Creek at Frazier's ranch, Mont., 1912.
Deep Creek near Chouteau, Mont., 1911–
Willow Creek near Chouteau, Mont., 1912–
Spring Creek near Strabane, Mont., 1913–
Muddy Creek near Bynum, Mont., 1912–
Blackleaf Creek near Bynum, Mont., 1912–
Judith River near Lewistown, Mont., 1910–11.
Musselshell River, North Fork (head of Musselshell River), near Delpine, Mont., 1909–10.
Musselshell River, North Fork, near Martinsdale, Mont., 1907–
Musselshell River at Harlowton, Mont., 1907–
Musselshell River at Shawmut, Mont., 1902–1907.
Musselshell River at Lavina, Mont., 1906.
Checkerboard Creek near Delpine, Mont., 1909–1912; 1913–
South Fork of Musselshell River near Martinsdale, Mont., 1907–
American Fork near Harlowton, Mont., 1907–1911; 1913–
Lebo Creek near Harlowton, Mont., 1907–1911; 1913–
Flatwillow Creek near Flatwillow, Mont., 1911–
Milk River, South Fork (head of Milk River), near Browning, Mont., 1905–
Milk River at international boundary, 1913–
Milk River at Havre, Mont., 1908–
Milk River at Chinook, Mont., 1897.
Milk River at Malta, Mont., 1902–
Milk River at Hinsdale, Mont., 1908–
West Fork of Milk River at Chinook, Mont., 1906–1909.
North Fork of Milk River near Kimball, Alberta, 1913–
North Fork of Milk River near Browning, Mont., 1911–12.
North Fork of Milk River near Chinook, Mont., 1905–
Beaver Creek near Saco (Ashfield), Mont., 1903–1906; 1908–1912.
Beaver Creek overflow near Bowdoin, Mont., 1903–1906; 1908–1912.
Rock Creek near Hinsdale, Mont., 1905–1907; 1912–
Porcupine Creek at Nashua, Mont., 1908–
Canals in Milk River basin:
Paradise Valley canal near Chinook, Mont., 1903–
Cook canal near Chinook, Mont., 1905–
Matheson canal near Chinook, Mont., 1905–
Reser ditch near Chinook, Mont., 1905–6.
West Fork ditch near Chinook, Mont., 1905–6.
Fort Belknap canal near Chinook, Mont., 1903–
Harlem canal near Zurich, Mont., 1903–
Agency ditch near Harlem, Mont., 1905–
Winter-Anderson canal near Chinook, Mont., 1906; 1908.
Rock Creek canal near Hinsdale, Mont., 1905–1907.

Missouri River tributaries—Continued.
- Little Porcupine Creek near Frazer, Mont., 1908–
- Wolf Creek near Wolf Point, Mont., 1908–
- Wolf Point ditch at Wolf Point, Mont., 1909.
- Poplar River near Poplar, Mont., 1908–
- Big Muddy Creek near Culbertson, Mont., 1908–
- Yellowstone River at Canyon Hotel, Mont., 1913–
- Yellowstone River at Corwin, Mont., 1910–
- Yellowstone River near Horr, Mont., 1889–1893.
- Yellowstone River at Livingston, Mont., 1897–1905.
- Yellowstone River at Billings, Mont., 1904–5.
- Yellowstone River at Huntley, Mont., 1907–
- Yellowstone River at Junction, Mont., 1906–7.
- Yellowstone River near Glendive, Mont., 1897–
  - Big Timber Creek, North Fork, near Big Timber, Mont., 1907–1911.
  - Big Timber Creek near Big Timber, Mont., 1912–
    - South Fork of Big Timber Creek near Big Timber, Mont., 1907–1911.
  - Boulder River near Contact, Mont., 1910–
  - Boulder River near McLeod, Mont., 1912–
    - East Fork of Boulder River near McLeod, Mont., 1907–1909.
    - West Fork of Boulder River near Bruffeys, Mont., 1907–1910.
    - West Fork of Boulder River at McLeod, Mont., 1907–
  - Sweetgrass Creek above Melville, Mont., 1907–
  - Sweetgrass Creek below Melville, Mont., 1907–
  - Stillwater River near Nye, Mont., 1911–1913.
  - Stillwater River near Absarokee, Mont., 1910–
    - Woodbine Creek near Nye, Mont., 1911–1913.
    - Rosebud River at Absarokee, Mont., 1910–
  - Clark Fork at Fromberg, Mont., 1905–
  - Pryor Creek near Coburn, Mont., 1911–
  - Pryor Creek at Huntley, Mont., 1904–
  - Wind River (head of Bighorn) at Dubois, Wyo., 1911–12.
  - Wind River near Wind River, Wyo., 1908–9.
  - Wind River at Riverton, Wyo., 1906–1908; 1911–12.
  - Bighorn River at Thermopolis, Wyo., 1900–1905; 1910–12.
  - Bighorn River near Hardin, Mont., 1904–
    - Warm Spring Creek near Dubois, Wyo., 1911–12
    - Horse Creek at Dubois, Wyo., 1911–12.
    - Red Creek near Dubois, Wyo., 1909.
    - Dinwoody Creek near Crowheart, Wyo., 1909.
    - Meadow Creek near J. K. ranch, Wyo., 1909.
    - Willow Creek at J. K. ranch, Wyo., 1909.
    - Bull Lake Creek near J. K. ranch, Wyo., 1909.
    - Dry Creek at Crowheart, Wyo., 1909.
    - Little Wind River at Fort Washakie, Wyo., 1908–9.
    - Little Wind River above Arapahoe, Wyo., 1906–1909; 1911–12.
    - Little Wind River below Arapahoe, Wyo., 1906–1909; 1911–12.
      - South Fork of Little Wind River near Wind River, Wyo., 1909.
      - St. Lawrence Creek near Wind River, Wyo., 1909.
      - Trout Creek at Wind River, Wyo., 1909.
      - Popo Agie River near Lander, Wyo., 1911–12.
      - Little Popo Agie River at Hudson, Wyo., 1907–1909; 1911–1912.
    - Owl Creek near Thermopolis, Wyo., 1910–1912.

Missouri River tributaries—Continued.
Yellowstone River—Continued.
Bighorn River—Continued.
No Wood River at Bonanza, Wyo., 1910–1912.
Tensleep Creek near Tensleep, Wyo., 1910–1912.
Paintrock Creek near Hyattville, Wyo., 1911–12.
Paintrock Creek near Bonanza, Wyo., 1910–1912.
Grey Bull River near Meeteetse, Wyo., 1897; 1903; 1910–1912.
Wood River near Meeteetse, Wyo., 1910–1912.
Shoshone River at Cody, Wyo., 1902–1910.
Shoshone River at Corbett dam, Wyo., 1908–
Shoshone River near Lovell, Wyo., 1897–1899.
South Fork of Shoshone River, at Marquette, Wyo., 1896; 1903–1908.
Rottengrass Creek near St. Xavier, Mont., 1911–
Soap Creek near St. Xavier, Mont., 1911–
Little Bighorn River in sec. 28, T. 8 S., R. 35 E., near Wyola, Mont., 1911–
Little Bighorn River at Crow Agency, Mont., 1905–6; 1911–
Prairie Dog ditch near Story, Wyo., 1903.
Lodgegrass Creek near Lodgegrass, Mont., 1911-
Tongue River near Dayton, Wyo., 1903; 1911–12.
Tongue River at Carneyville, Wyo., 1911–1912.
Goose Creek at Sheridan, Wyo., 1895–1897; 1911–1912.
Little Goose Creek at Sheridan, Wyo., 1896–7; 1911–1912.
Powder River:
South Fork of Powder River near Kaycee, Wyo., 1911.
Middle Fork of Powder River near Kaycee, Wyo., 1911–1912.
North Fork of Powder River near Kaycee, Wyo., 1911.
Clear Creek at Buffalo, Wyo., 1896–1900; 1902–1904; 1911–12.
Clear Creek near Buffalo, Wyo., 1911–1912.
Piney Creek at Kearney, Wyo., 1902–1906; 1911–1912.
Cruez ditch near Story, Wyo., 1903.
Little Muddy River near Williston, N. Dak., 1904–1909.
Little Missouri River near Alzada, Mont., 1904–1906; 1911–
Little Missouri River at Camp Crook, S. Dak., 1903–1906.
Little Missouri River at Medora, N. Dak., 1903–1908.
Knife River near Broncho, N. Dak., 1903–
Painted Woods Creek near Washburn, N. Dak., 1909–10.
Turtle Creek near Washburn, N. Dak., 1909–10.
Heart River near Richardton, N. Dak., 1903–
Apple Creek near Bismarck, N. Dak., 1905.
Cannonball River near Stevenson, N. Dak., 1903–1908; 1911–
Grand River, North Branch, at Haley, N. Dak., 1908–
Grand River near Seim, S. Dak., 1904–1906.
Grand River near Wakpala, S. Dak., 1911–
Owl (Moreau) River near Bixby, S. Dak., 1904–1906.
Cheyenne River at Edgemont, S. Dak., 1903–1906.
Beaver Creek near Edgemont, S. Dak., 1905–6.
Hat Creek near Edgemont, S. Dak., 1905–6.
Battle Creek near Hermosa, S. Dak., 1903.
Spring Creek near Rapid, S. Dak., 1903–1906.
Rapid Creek at Rapid, S. Dak., 1903–1906.
Box Elder Creek at Blackhawk, S. Dak., 1903–1905.
Corbin Morse ditch at Rapid, S. Dak., 1906.

Missouri River tributaries—Continued.
Cheyenne River—Continued.
Elk Creek near Piedmont, S. Dak., 1903.
Belle Fourche River at Bellefourche, S. Dak., 1903–1906.
Belle Fourche River near Bellefourche, S. Dak., 1906; 1912–
Redwater River at Bellefourche, S. Dak., 1903–1906.
Redwater River near Minnesela, S. Dak., 1903.
Redwater canal at Minnesela, S. Dak., 1904–1906.
Spearfish Creek near Spearfish, S. Dak., 1903–1906.
Crow Creek near Bellefourche, S. Dak., 1904.
Owl Creek near Bellefourche, S. Dak., 1904.
Indian Creek near Bellefourche, S. Dak., 1904.
White River at Crawford, Nebr., 1897.
White River near Interior, S. Dak., 1904–1906; 1911–
White River near Westover, S. Dak., 1911–
Little White River near Westover, S. Dak., 1912–
Niobrara River near Valentine (Fort Niobrara), Nebr., 1897; 1899; 1901–1906.
Niobrara River near Spencer, Nebr., 1908.
Niobrara River at Niobrara, Nebr., 1902; 1910–
Red Deer Lake (head of Plum Creek) near Woodlake, Nebr., 1904–5.
James River near Lamoure, N. Dak., 1903.
Big Sioux River near Watertown, S. Dak., 1900–1903.
Big Sioux River near Sioux Falls, S. Dak., 1900–1901.
Rock River at Luverne, Minn., 1911–
Big Grizzly Creek (head of North Platte River) near Hebron, Colo., 1904–5.
North Platte River near Hebron, Colo., 1904–5.
North Platte River near Cowdrey, Colo., 1904–5.
North Platte River near Pinkhampton, Colo., 1904.
North Platte River at Saratoga, Wyo., 1903–1906, 1909; 1911–1912.
North Platte River at Pathfinder, Wyo., 1905–
North Platte River at Alcova, Wyo., 1904–5.
North Platte River near Douglas, Wyo., 1894.
North Platte River near Orin Junction, Wyo., 1895–1900.
North Platte River at Guernsey, Wyo., 1900–1908; 1912.
North Platte River near Fort Laramie, Wyo., 1887–1890.
North Platte River and Interstate canal at Whalen, Wyo., 1909–
North Platte River near Mitchell, Nebr., 1901–1913.
North Platte River at Scottsbluff, Nebr., 1912.
North Platte River near Gering, Nebr., 1897–1900.
North Platte River near Camp Clark, Nebr., 1896–1900.
North Platte River at Bridgeport, Nebr., 1902–1906.
North Platte River near Henry, Nebr., 1912–
North Platte River at North Platte, Nebr., 1895–
Platte River near Lexington, Nebr., 1902–1906.
Platte River near Columbus, Nebr., 1895–
Platte River near Fremont, Nebr., 1913–
Platte River near Leshara, Nebr., 1911–
Platte River near South Bend, Nebr., 1903.
Little Grizzly Creek at Hebron, Colo., 1904–5.
Roaring Fork of North Platte River near Hebron, Colo., 1904–5.
North Fork of North Platte River at Higho, Colo., 1904–5.
Michigan Creek near Walden, Colo., 1904–5.
Michigan Creek near Cowdrey, Colo., 1904–5.
Canadian River at Cowdrey, Colo., 1904–5.

Missouri River tributaries—Continued.
Platte River—Continued.
Big Creek near Downington, Wyo., 1911–12.
Mullen Creek near French, Wyo., 1911–12.
French Creek near French, Wyo., 1911–1912.
Brush Creek near Saratoga, Wyo., 1911–1912.
Encampment River near Peryam's ranch, Wyo., 1900.
Encampment River at Encampment, Wyo., 1911–1912.
Cow Creek near Saratoga, Wyo., 1911–12.
Spring Creek near Saratoga, Wyo., 1911–1912.
Jack Creek at Blydenburg's ranch near Saratoga, Wyo., 1912.
Jack Creek near Saratoga, Wyo., 1911–12.
Pass Creek near Walcott, Wyo., 1911.
Medicine Bow River near Medicine Bow, Wyo., 1901; 1911–1912.
Rock Creek near Arlington, Wyo., 1911–
Rock Creek near Rock River, Wyo., 1911–1912.
Sweetwater River near Splitrock, Wyo., 1902–3.
Boxelder Creek near Careyhurst, Wyo., 1911.
Laramie River at Glendevey, Colo., 1904–5; 1910–
Laramie River near Jelm, Wyo., 1904–5; 1911–
Laramie River near Woods Landing, Wyo., 1895–1900; 1911.
Laramie River and Pioneer canal near Woods, Wyo., 1912.
Laramie River near Uva, Wyo., 1895–1900; 1903.
Laramie River at Two Rivers, Wyo., 1911–1912.
Laramie River near Wheatland, Wyo., 1912.
McIntyre Creek near Gleneyre, Colo., 1904–5.
Little Laramie River near Filmore, Wyo., 1911–1912.
Little Laramie River near Hatton, Wyo., 1902–3.
Little Laramie River near Laramie, Wyo., 1903.
Little Laramie River at Two Rivers, Wyo., 1911–1912.
Sybilee Creek near Wheatland, Wyo., 1912.
North Laramie River, near Wheatland, Wyo., 1912.
North Laramie River at Uva, Wyo., 1911–1912.
Chugwater Creek at Chugwater, Wyo., 1911–1912.
Horse Creek near Little Horse Creek, Wyo., 1911–1912.
Horse Creek near Lagrange, Wyo., 1911–1912.
South Platte River, South Fork (head of South Platte), near Cheeseman Lake, Colo., 1899–1901.
South Platte River, South Fork, at Lake George, Colo., 1910–
South Platte River, South Fork, at South Platte, Colo., 1905–1912.
South Platte River at South Platte, Colo., 1902–
South Platte River near Deansbury (Platte Canyon), Colo., 1887–1892; 1895–1900.
South Platte River at Denver, Colo., 1895–
South Platte River near Kersey, Colo., 1901–1903; 1905–
South Platte River near Orchard, Colo., 1895–1900.
South Platte River at Julesburg, Colo., 1902–1906; 1908–
South Platte River near Big Spring, Nebr., 1902–3.
Tarryall Creek near Jefferson, Colo., 1910–
Tarryall Creek near Hayman, Colo., 1910–1912.
Jefferson Creek at Jefferson, Colo., 1910–1912.
Michigan Creek near Jefferson, Colo., 1910–1912.

Missouri River tributaries—Continued.
Platte River—Continued.
South Platte River—Continued.
Goose Creek near Cheeseman Lake, Colo., 1899.
Middle Fork of South Platte River at Fairplay, Colo., 1910–12.
North Fork of South Platte River at Grant, Colo., 1910–
North Fork of South Platte River at Cassells, Colo., 1908–
North Fork of South Platte River at South Platte, Colo., 1909–10; 1913–
Geneva Creek above Jackwhacker Creek, near Grant, Colo., 1909–1911.
Geneva Creek at Old Geneva smelter, near Grant, Colo., 1909–1911.
Geneva Creek at Sullivan's ranch, near Grant, Colo., 1908–1911.
Geneva Creek at Grant, Colo., 1911–12.
Smelter Creek at Old Geneva smelter, near Grant, Colo., 1909–1911.
Duck Lake Creek near Grant, Colo., 1909–1911.
Scott Gomer Creek at Sullivan's ranch, near Grant, Colo., 1909–
Bear Creek near Morrison, Colo., 1888–1891; 1895–1902.
Clear Creek at Idaho Springs, Colo., 1910–1912.
Clear Creek at Forkscreek, Colo., 1899–1912.
Clear Creek near Golden, Colo., 1908–1909; 1911; 1913–
St. Vrain Creek at Lyons, Colo., 1887–1890; 1895–1903; 1904–
Boulder Creek at Orodell, Colo., 1887–1890; 1907–
Boulder Creek near Boulder, Colo., 1888–1892; 1895–1901; 1907–1909.
South Boulder Creek near Rollinsville, Colo., 1910–
South Boulder Creek at Eldorado Springs (near Marshall), Colo., 1888–1892; 1895–1901; 1909–
Community canal near Marshall, Colo., 1909.
Big Thompson Creek near Arkins, Colo., 1888–1890; 1895–1903; 1904–1911.
Handy ditch near Arkins, Colo., 1899–1900; 1903.
Cache la Poudre River near Elkhorn, Colo., 1909–1911.
Cache la Poudre River near Fort Collins, Colo., 1909–1911.
Cache la Poudre River at mouth of canyon near Fort Collins, Colo., 1884–1901; 1910–
Cache la Poudre River near Greeley, Colo., 1903.
Middle Crow Creek near Hecla, Wyo., 1902–3.
Middle Loup River (head of Loup River) near St. Paul, Nebr., 1895; 1897; 1899; 1903.
Loup River at Columbus, Nebr., 1894–
North Loup River near St. Paul, Nebr., 1895; 1897; 1899; 1903.
Elkhorn River near Norfolk, Nebr., 1896–1903.
Elkhorn River at Arlington, Nebr., 1899–1903; 1913–
Elkhorn River at Waterloo, Nebr., 1911–
South Fork of Elkhorn River, near Norfolk, Nebr., 1896.
Republican River, North Fork (head of Kansas River), near Haigler, Nebr., 1896.
Republican River, North Fork, near Benkleman, Nebr., 1894–95.
Republican River at Benkleman, Nebr., 1903–1906.
Republican River at Culbertson, Nebr., 1913–
Republican River at Bostwick, Nebr., 1904–
Republican River near Superior, Nebr., 1896–1903.
Republican River at Junction, Kans., 1895–1905.
Kansas River near St. George, Kans., 1904.
Kansas River near Topeka, Kans., 1904.
Kansas River near Lecompton, Kans., 1899–1906.

Missouri River tributaries—Continued.
Kansas River near Lawrence, Kans., 1895–1899.
South Fork of Republican River at Benkleman, Nebr., 1895; 1903–1906.
Frenchman River at Culbertson, Nebr., 1913–
Frenchman River near Wauneta, Nebr., 1895–6.
Frenchman River near Palisade, Nebr., 1895–6.
Smoky Hill River at Ellsworth, Kans., 1895–1905.
Smoky Hill River at Solomon, Kans., 1904.
Beaver (Ladder) Creek near Scott City, Kans., 1904–5.
Saline River near Beverly, Kans., 1895–1897.
Saline River near Salina, Kans., 1897–1903.
Solomon River at Beloit, Kans., 1895–1897.
Solomon River near Niles, Kans., 1897–1903.
Big Blue River (head of Blue River) at Beatrice, Nebr., 1910–
Blue River at Manhattan, Kans., 1895–1905.
Little Blue River near Fairbury, Nebr., 1908–
Osage (Marais des Cygnes) River at Ottawa, Kans., 1902–1905.
Gasconade River at Arlington, Mo., 1903–1906.
Piney Fork of Gasconade River, near Houston, Mo., 1908–9.
Piney Fork of Gasconade River, near Hooker, Mo., 1903. (Also called Big Piney Creek.)
Little Piney Creek near Arlington, Mo., 1903.

REPORTS ON WATER RESOURCES OF THE MISSOURI RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water supply papers are of octavo size.

*5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 12 pls.

Describes reservoirs for storm and pumped waters, ditching methods of distributing water cultivation and subirrigation, duty of water, and winter irrigation.

*9. Irrigation near Greeley, Colo., by David Boyd. 1897. 90 pp., 21 pls.

Treats of topography, rainfall, and water supply in the valley of Cache la Poudre River, a tributary of the South Platte; describes the canals and reservoir systems, construction and operation of canals, and agricultural practice; discusses also the legislative and judicial control of the water; speaks of the use of the underground waters, effect of alkali waters on soil, pumping of underground waters, and artesian wells.

*12. Underground waters of a portion of southeastern Nebraska, by N. H. Darton. 1898. 56 pp., 21 pls.

Discusses physiography, geology, underground waters of moderate depth, and irrigation from underground waters in Lancaster, Seward, northern Saline, York, Fillmore, Hamilton-Clay, Hall, Adams, Buffalo, Kearney, Phelps, northern Gosper, and eastern and central Dawson counties; reviews briefly the prospects for obtaining deeper-seated waters.

29. Wells and windmills in Nebraska, by E. H. Barbour. 1899. 85 pp., 27 pls.

Describes home-made windmills; discusses briefly action of water underground, transmission and storage of windmills, precipitation, surface waters for irrigation, supply for cities and towns, salt water and blowing wells.

34. Geology and water resources of a portion of southeastern South Dakota, by J. E. Todd. 1900. 34 pp., 10 pls.

Describes areas in Turner, Hutchinson, Bonhomme, Yankton, and Clay counties, including typical sections of the valleys of James and Vermilion rivers.

43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls.

Describes the location and construction of various types of canals for irrigation.

70. Geology and water resources of the Patrick and Goshen Hole quadrangles, in eastern Wyoming and western Nebraska, by G. I. Adams. 1902. 50 pp., 11 pls. 15c.

Describes the geologic formations, surface features, water supply (surface and underground), irrigation, and agricultural products of a part of the Great Plains; discusses settlement and occupancy of the lands, and in an appendix gives the text of the "desert-lands" act, the Carey Act, and an act for the construction of reservoirs on public land for the watering of stock.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River irrigation divisions, drainage, and irrigation, and gives records of stream flow.

90. Geology and water resources of part of the lower James River Valley, South Dakota, by J. E. Todd and C. M. Hall. 1904. 47 pp., 23 pls. 35c.

Describes topography, geologic formations, and surface and underground waters of Davison, Hanson, Sanborn, Beagle, and Miner counties, and portions of Kingsbury, Jerauld, Aurora, and McCook counties, S. Dak.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1904. 361 pp. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Irrigation in North Dakota by pumping, by F. A. Wilder. Discusses the use of lignite as a fuel for the operation of farm engines.

South Dakota investigations, by Raymond F. Walter. Mentions surveys of reservoir sites on creeks north of Rapid City and the water supply of the Belle Fourche project.

Work on North Platte River in Wyoming, by John E. Field.

Investigations in Wyoming, by Jeremiah Ahern. Describes the Lake de Smet project and the Shoshone project.

Reclamation and water storage in Nebraska, by O. V. P. Stout. Describes North Platte River and discusses its possible use for irrigation. Gives tables showing monthly discharge of the river from 1895 to 1902 and the volume of storage necessary to insure water to meet possible demands. Describes also Frenchman, Loup, and Niobrara rivers.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives notes on early floods in Mississippi Valley, and describes floods on Kansas River and its tributaries (Blue, Republican, Solomon, Saline, and Smoky Hill rivers); gives an account of the losses and suggests methods of flood prevention; contains also discharge tables and compares flood and ordinary data.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on wells and springs of Minnesota and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains a brief report on the "Spring system of the Decaturville dome, Camden County, Mo., by E. M. Shepard." Some of these springs are of immense size and present many points of interest.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:
Missouri, by E. M. Shepard.
Iowa, by W. H. Norton.
Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.

117. The lignite of North Dakota and its relation to irrigation, by F. A. Wilder. 1905. 59 pp., 8 pls. 10c.

Describes the thickness, extent, variations, and fuel value of the lignite and its use for pumping water, the area, soils and lignite of the river flats, and the status of irrigation in the State.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, Chief Engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the Reclamation Service.]

Contains brief account of the organization of the hydrographic (water resources) branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service.
A brief report on "Irrigation development in North Dakota," by H. A. Storrs. Discusses the feasibility of pumping water from the Missouri to irrigate bench lands along its banks.

147. Destructive floods in United States in 1904, by E. C. Murphy. 15c. Contains:

Belle Fourche River flood, South Dakota, from report of R. F. Walter. Describes floods on Belle Fourche River (tributary to the Missouri through Cheyenne River) and on Cache la Poudre River and Crow Creek (tributaries of the South Platte).

162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives accounts of floods in eastern Missouri and South Dakota, and estimates of flood discharge and frequency on Kansas, Loup, and Platte rivers; contains also index to literature on floods in American streams.

184. The underflow of the South Platte Valley, by C. S. Slichter and H. C. Wolff. 1906. 42 pp. 5c.

Describes investigations of velocity, direction, quantity of underflow and the underflow ditch at Ogalalla, Nebr., gives chemical analyses of the water, and discusses disadvantages of underflow canals; describes also the investigation at North Platte, Nebr., and gives suggestions for construction of small pumping plants.

195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties, gives statistics of city water supplies, analyses of waters, and many well records.

215. Geology and water resources of a portion of the Missouri River valley in northeastern Nebraska, by G. E. Condra. 1908. 208 pp., 3 pls. 40c.

Describes topography, rock formations, mineral resources, streams, springs, shallow and artesian wells, soils, crops, and timber, in Boyd, Knox, Cedar, Dixon, and Dakota counties, and part of Holt County.

216. Geology and water resources of the Republican River valley and adjacent areas, Nebraska, by G. E. Condra. 1907. 71 pp., 4 pls. 15c.

Describes topography, drainage, temperature, rainfall, winds, rock systems, surface and underground waters, water powers, soils, crops, and timbers of Dundy, Hitchcock, Redwillow, Furnas, Harlan, Franklin, Webster, Nuckolls, Thayer, and Jefferson counties.

221. Geology and water resources of the Great Falls region, Montana, by C. A. Fisher. 1909. 89 pp., 7 pls. 20c.

Describes the topographic features, geologic formation, streams, lakes, swamps, springs, and artesian wells of a portion of the Great Plains in Cascade, Teton, Fergus, Chouteau, and Lewis and Clark counties; discusses the chemical character of the waters (analyses), water powers, irrigation, temperature, rainfall and culture, and gives details of water supplies by districts.

230. Surface water supply of Nebraska, by J. C. Stevens. 1909. 252 pp., 6 pls. 35c.

Discusses relation of rainfall to run-off and evaporation and seepage near Kearney; describes the river basins, and gives results of observations at gaging stations.

236. The quality of surface waters in the United States: Part I, Analyses of water east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Missouri, North Platte, and Platte rivers.

258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 125 pp., 2 pls. 15c.

Contains brief report entitled "The utilization of the underflow near St. Francis, Kans.," by H. C. Wolff; discusses the water-bearing material, velocity, amount, rate of movement, and quality of the waters; arrangement and method of sinking the wells, selection and installation of pumps, engines and cost of pumping, storage reservoirs and loss by evaporation.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 15c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and method of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from mills, Yellowstone, Shoshone, Belle Fourche and Redwater rivers.

293. Underground water resources of Iowa, by W. H. Norton, W. S. Hendrixson, H. E. Simpson, O. E. Meinzer, and others. 1912. 994 pp., 18 pls. 70c.

Describes the relief, drainage, temperature, and precipitation of the State and the geologic formations; discusses the geologic occurrence of underground waters, artesian phenomena and yield of artesian wells, the chemical composition of underground waters, municipal, domestic, and industrial water supplies, and mineral waters; gives details concerning topography, geology, underground waters, and city and village supplies by districts and counties.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II, Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, pp. xiv, 395, 30 plates and maps. $1.25. Contains:

* Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurements, rainfall, and evaporation, and describes the more important streams.

* Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

* The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

* Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

* Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2.00. Contains:

* Report upon the locationand survey of reservoir sites during the fiscal year ended June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites in Meagher, Lewis and Clark, Beaverhead, Madison, Chouteau, Cascade, and Fergus counties, Mont., and for each site gives the location, brief description of the drainage basin, height of dam, capacity of reservoir, and the area of segregated land.

* Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

* Water supply for irrigation, by F. H. Newell, pp. 1–99, Pls. CLIII–CX. Discusses areas irrigated and irrigable, fluctuations in rivers and lakes, cost and value of water supply, and describes the location and area, topography, land classification, extent of irrigation, precipitation, and water measurements on the upper Missouri and its tributaries in the Yellowstone basin and in the Platte River basin; for each reservoir site gives the location, height of dam, areas inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

* Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, Pls. CXLVII–CLXXXII. Describes the reservoirs, canal lines, areas of lands reclaimable, and estimated revenue from irrigation works on the Sun River system, Montana.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes the general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Water resources of a portion of the Great Plains, by Robert Hay, pp. 535–588, Pls. XL–XLII. Describes an area comprising between 5,000 and 6,000 square miles and including parts of three counties of Kansas, five counties of Nebraska, and six of Colorado, drained to the Missouri through Platte and Kansas rivers; discusses the lakes, streams, and springs of the area, the underflow of the river bottoms, and the water-bearing strata under the higher lands; treats also of the sources of the water supply, rainfall, rate of percolation, volume; valley, upland, and deep wells; waterless wells, artesian flow, and blowing wells; and the temperature of the well waters; describes briefly the topography and geology of the region and the utilization of the water supply.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. Pt. II. Economic geology and hydrography, pp. xxv, 864, 113 pls. $2.35. Contains:

Preliminary report on artesian waters of a portion of the Dakotas, by N. H. Darton, pp. 603–694, Pls. LXIX–CVII. Gives an outline of the geologic relations; describes the water horizons and the extent of the artesian water, and gives details concerning wells and prospects by counties; discusses the origin, amount, pressure, head, and composition of the artesian waters, the use of artesian water for power, and gives details concerning artesian irrigation by counties; contains also remarks on the construction and management of artesian wells.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, pp. x, 756, 102 plates. $1.75. Contains:

*New developments in well boring and irrigation in eastern South Dakota, by N. H. Darton, pp. 561–616, Pls. XXXVIII–XLVII. Discusses progress in well sinking and irrigation by artesian waters in 1896 in Aurora, Beadle, Bonhomme, Brule, Buffalo, Charles Mix, Davison, Douglas, Hanson, Hutchinson, Jerauld, Sanborn, Spink, and Yankton counties, South Dakota, and in areas west of the Missouri River; treats also of the temperature and volume of flow of the deeper artesian waters and gives chemical analyses of waters from Missouri River and from artesian wells in the Sanborn basin.

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, Pls. XLVII–CII. Describes reservoir sites on Goose Creek, Tarryall Creek, and South Fork Platte River in Colorado; gives tables of reservoir capacity and areas.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, pp. viii, 814, 118 plates. $1.85. Contains:

* Preliminary report on the geology and water resources of Nebraska, west of the 103d meridian, by N. H. Darton, pp. 710–785, Pls. LXXIV–CXVIII. Describes topography and drainage (to the North Platte) of the area, the general geology of Nebraska, and the geology of the area covered by the report, the water horizons, and deep-seated waters; discusses springs, streams, irrigation, climate, and timber, and gives list of elevations.

——— Pt. V, Forest Reserves, pp. xvii–400, 110 pls. (16 maps in separate case; paper, 75c.; cloth, $1.00). $1.25. Contains:

*Black Hills Forest Reserve, by H. S. Graves, pp. 67–164, Pls. XIV–XXXVI.
*Bighorn Forest Reserve, by F. E. Town, pp. 165–190, Pls. XXXVII–XLII.
*Yellowstone Park Forest Reserve, southern part, from notes by T. S. Brandegee, pp. 213–216.
These reports contain many descriptions of the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest Reserves, pp. xix, 498, 159 plates, 8 maps in separate case. $2.80. Contains:

*Pikes Peak, Plum Creek, and South Platte rivers, by J. G. Jack, pp. 39–115, Pls. VIII–XLVII. Describes briefly the drainage of the forest reserves.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Pts. III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. Pt. IV, Hydrography, pp. 768, 156 pls. $2.35. Contains:

*Preliminary description of the geology and water resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming, by N. H. Darton, pp. 489–599, Pls. LVIII–CXII. Describes the topography and geology of an area comprising about 5,500 square miles in southwestern corner of South Dakota, in the adjoining portion of Wyoming, Texas, the geologic formations and their contained waters, the deep borings at Edgemont and other places, the surface waters (Cheyenne and Fall River, Beaver, Lame Johnny, French, Battle Spring, Hat, Cascade, and Stockade Beaver creeks), and irrigation, the soils, mineral resources, climate, and temperature.

Twenty-first Annual Report, etc.—Continued.

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, Pls. CXIII–CLVI. Describes the area lying in an irregular belt lying about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Platte, Republican, and Smoky Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of the High Plains, the precipitation, temperature and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, Pls. LI–LXV.

——— Pt. V, Forest Reserves, 711 pp., 143 pls., 39 maps in separate case. $3.85. Contains:

*Lewis and Clarke Forest Reserve, Montana, by H. B. Ayres, pp. 27–80, Pls. II–XXXII. Briefly describes the valleys of the streams which drain into Missouri River.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Kansas and Missouri, and detailed records of wells in Greeley County, Kansas, and Randolph County, Missouri. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming, and detailed records of wells in Geary and Wyandotte County, Kansas; Jackson County, Missouri; Teton County, Montana; and Beadle and Miner counties, South Dakota. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*17. Preliminary report on the geology and water resources of Nebraska west of the one hundred and third meridian, by N. H. Darton. 1903. 69 pp., 42 pls. 25c.

Describes the climate, timber, topography, and general geology of Nebraska, the streams, springs, and deep-seated waters, irrigation in the valley of the North Platte, and gives list of elevations west of the one hundred and third meridian.

*32. Geology and underground water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls. $1.80.

Describes altitudes and slopes, climate, drainage, stratigraphic structure, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota, Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming; discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*53. The geology and water resources of the Bighorn basin, Wyoming, by C. A. Fisher. 1907. 72 pp., 16 pls.

Describes the relief and drainage, climate and culture; the stratigraphic, structural, and historical geology, and the underground waters, coal, oil, and gas, building stone, and other mineral resources; discusses briefly irrigation and mineral waters.

65. Geology and underground waters of the northern portion of the Black Hills and adjoining regions in South Dakota and Wyoming, by N. H. Darton. 1909. 105 pp., 24 pls. 40c.

Describes topographic development, the stratigraphic, structural, and historical geology of the sedimentary rocks, and discusses their mineral resources, including underground water, coal gypsum, etc.; contains also information concerning the timber, climate, and the surface waters available for irrigation and stock raising.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys, and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive; also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

24. Three Forks, Montana.

Describes topography and geology and, under "Economic geology," the mineral springs of the district, including Ferris Hot Springs.

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[1] Index maps showing areas in the Missouri River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

55. Fort Benton, Montana.

Describes the topographic features and geologic formations of the area and, under "Economic geology," gives a brief paragraph on the artesian waters.

56. Little Belt Mountains, Montana.

Describes the geography and geology of the area and, under "Mineral resources," the hot waters of White Sulphur Springs, of which it gives an analysis.

87. Camp Clark, Nebraska.

Describes the geography and geology of an area lying west of the Scotts Bluff quadrangle gives table of average rainfall in western Nebraska 1886–1897 and, under "Economic geology," discusses underground waters and water for irrigation.

88. Scotts Bluff, Nebraska.

Describes the topography and drainage of the area; gives table of average rainfall from 1886–1897; discusses the geology and, under "Economic resources," the geology, underground waters, and water supply for irrigation.

96. Olivet, South Dakota.

Describes the topography, general geology, and geologic history of an area in the drainage basin of James River, and, under "Economic geology," discusses the surface waters—lakes, springs, and streams—and the underground waters, including the waters from the till and from the older rocks; contains an artesian-water sheet which shows the area of probable flowing wells; discusses artesian pressure, volume of flow, the probabilities of obtaining additional flow, and gives sug, gestions as to the construction of wells.

97. Parker, South Dakota.

Describes the topography and drainage of the quadrangle, the general geology and the geologic history, and, under "Economic geology," the surface and underground waters; discusses the formations yielding artesian flows, the amount of the flow, the quality of the water, and the causes of apparent decline in pressure; contains an artesian-water map showing areas which will probably yield flowing wells.

99. Mitchell, South Dakota.

Describes the topography and drainage of the quadrangle, the general geology and the geologic history, and, under "Economic geology," the surface and underground waters; discusses the formations yielding artesian flows, the amount of the flow, the quality of the water, and the causes of apparent decline in pressure; contains an artesian water map showing areas which will probably yield flowing wells.

100. Alexandria, South Dakota.

Describes the topography and drainage of the quadrangle, the general geology and the geologic history, and, under "Economic geology," the surface and underground waters; discusses the formations yielding artesian flows, the amount of the flow, the quality of the water, and the causes of apparent decline in pressure; contains an artesian water map showing areas which will probably yield flowing wells.

113. Huron, South Dakota.

Describes an area in the valley of James River; discusses topography, general geology and geologic history, and, under "Economic geology," the water resources, including lakes, springs, and streams, and shallow and deep wells; gives an account of the water horizons of the main artesian supply and the limits of the artesian area, and discusses causes of apparent decline in pressure; contains an artesian-water map showing areas in which wells may be expected to flow.

114. De Smet, South Dakota.

Describes an area which drains in part through James River to the Missouri, and in part into a local system of lakes which sometimes overflow into the basin of the Big Sioux and may thus reach Missouri River; discusses the general geology and geologic history, and, under "Economic geology," the water resources, including the lakes, springs, and streams, and shallow and deep wells; gives an account of the water horizons of the main artesian supply, and the limits of the artesian area; and discusses causes of apparent decline in pressure; contains an artesian water map showing areas in which wells may be expected to flow.

127. Sundance, Wyoming-South Dakota.

Describes the general features of the Black Hills in the Red River valley, and the stratigraphic and structural geology and geologic history and, under "Economic geology," discusses the surface and underground waters; gives analyses of water from well at Jerome, South Dakota.

128. Aladdin, Wyoming-South Dakota-Montana.

Describes relief, drainage, stratigraphic, structural, and historical geology and, under "Economic products," discusses surface and underground waters.

*150. Devils Tower, Wyoming.

Describes the topography and geology of an area in Crook County, Wyo., embracing portions of the Belle Fourche and Missouri River valleys; under "Economic geology" discusses the rainfall, the streams, and the geologic formation that furnish underground waters.

156. Elk Point, South Dakota-Nebraska-Iowa.

Describes the relief, drainage, and geology of an area in the Missouri Valley, mainly in Union and Clay counties, S. Dak.; but including also portions in Dixon and Dakota counties, Nebr., and Plymouth and Sioux counties, Iowa; under "Economic geology" describes the springs, lakes, ponds, streams, and water powers, shallow and artesian wells, and the amount of flow, kind of pressure, in the artesian wells; contains an artesian water map to show areas in which flowing wells may probably be obtained.

165. Aberdeen-Redfield[1] (Northville, Aberdeen, Redfield, and Bryan quadrangles), South Dakota.

Describes the relief and drainage and geology of an area in eastern South Dakota comprising nearly all of Spink County, and portions of Falk, Hand, Edmund, and Beadle counties; under "Economic geology" describes the shallow and deep wells, and the artesian wells; discusses the volume of flow, variations in flow, and pressure of artesian wells, and gives a table of pressure in representative wells; gives analyses of artesian water in the quadrangle; contains artesian water map showing areas in which flowing wells can probably be obtained.

168. Jamestown-Tower[1] (Jamestown, Eckelson, and Tower quanrangles), North Dakota.

Describes an area in eastern North Dakota including a portion of Cass, Barnes, Stutsman, Ransom, and Lamoure counties, drained in part by streams that ultimately discharge into Hudson Bay and in part by streams that finally reach the Gulf of Mexico; describes the relief, drainage, and geology of the area, and, under "Economic geology," shallow, deep, and artesian wells; discusses head, pressure, power, volume, and character of the water; and gives a tabulated list of representative wells; contains an artesian water map showing areas in which flowing wells may probably be obtained.

181. Bismarck,[1] North Dakota.

Describes the relief, drainage, and geology of the quadrangle in which Bismarck is situated, under "Economic geology" describes the streams, all of which are tributary to the Missouri, shallow dug wells, tubular wells, and flowing wells.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the Missouri River basin are the reports of the Chief of Engineers United States Army, of the State geologist of Kansas, the State Drainage Commission of Minnesota, the Commission on Conservation of the State of Montana, the State Board of Irrigation of Nebraska, the superintendent of the Department of Irrigation, Forestry, Fish, and Game of North Dakota, and the State engineer of Wyoming. The following reports deserve special mention:

The Missouri River and its utmost sources, by J. V. Brower. St. Paul, 1897.

Geological report of the exploration of the Yellowstone and Missouri Rivers, by F. V. Hayden. Washington, 1869.

[1] Issued in two editions—library and octavo (see p. 78). Specify edition desired.

Preliminary examination of reservoir sites in Wyoming and Colorado: 55th Cong. 2d session, House Doc. 141.

Report of a commission appointed by his excellency the governor of the State of Colorado to revise the laws of the State of Colorado regulating the appropriation, distribution, and use of water. Denver, 1890.

Special report on well waters of Kansas, by Erasmus Haworth; Kansas Univ. Geol. Survey Bull. 1.

Report of Board of Irrigation Survey and Experiment [Kansas] for 1895–96. Topeka, 1897.

Report of the water-resources investigation of Minnesota by the State Drainage Commission. St. Paul, 1910.

Report of the commission on conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests. Helena, 1911.

Irrigation laws of the State of Wyoming; compiled in the office of the State engineer.

Part VII. LOWER MISSISSIPPI RIVER BASIN.

PRINCIPAL STREAMS.

The principal streams flowing into the Mississippi below the mouth of the Ohio are Meramec, White, Arkansas (whose chief tributaries are Huerfano, Purgatory, Cimarron, Verdigris, Neosho, Canadian, and Mora rivers), Yazoo, Homochitto, and Red rivers. The streams drain wholly or in part the States of Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas.

In addition to the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 93.)

GAGING STATIONS.

Note.—Dash after a date indicates that station was being maintained June 30, 1913; period after a date indicates discontinuance.

MERAMEC RIVER BASIN.

Meramec River near Meramec, Mo., 1903–1906.
Meramec River near Eureka, Mo., 1903–1906.
Meramec River (Station No. 1) at Fenton, Mo., 1903.
Meramec River (Station No. 2) below Fenton, Mo., 1903.
Meramec Spring near Meramec, Mo., 1903–1906.
Courtois Creek at Scotia, Mo., 1904–1906.

WHITE RIVER BASIN

White River at Beaver, Ark., 1909–10.
White River near Branson, Mo., 1909–10.
White River near Lead Hill, Ark., 1909–10.
White River near Cotter, Ark., 1909–10.
White River at Walls Ferry, Ark., 1909–10.
Buffalo River near Gilbert, Ark., 1909–10.
North Fork River near Henderson, Ark., 1909–10.
Greer Spring at Greer, Mo., 1904.
Little Red River near Pangburn, Ark., 1909–1911.

ARKANSAS RIVER BASIN.

Arkansas River, East Fork (head of Arkansas), near Leadville, Colo., 1890; 1903; 1911–
Arkansas River at Granite, Colo., 1895; 1897–1901; 1910–
Arkansas River at Salida, Colo., 1895–1903; 1909–
Arkansas River at Canon City, Colo., 1888–
Arkansas River near Rock Canyon, Colo., 1889.
Arkansas River at Pueblo, Colo., 1885–1887; 1889; 1894–

Arkansas River near Nepesta, Colo., 1897–1903; 1909–
Arkansas River at New Fort Lyons, Colo., 1911.
Arkansas River near Manzanola, Colo., 1897–98.
Arkansas River near Rocky Ford, Colo., 1897–1900; 1901–1903.
Arkansas River at La Junta, Colo., 1889; 1893–1895; 1901; 1903; 1908; 1912–
Arkansas River at Las Animas, Colo., 1898; 1909.
Arkansas River near Prowers, Colo., 1889–1901; 1903.
Arkansas River near Amity canal head-gates, Colo., 1898–99.
Arkansas River near Lamar, Colo., 1913–
Arkansas River near Granada, Colo., 1898–1901; 1903.
Arkansas River near Holly (Barton or Byron), Colo., 1893–94; 1901–2; 1907-
Arkansas River near Syracuse, Kans., 1902–1906.
Arkansas River near Coolidge, Kans., 1903.
Arkansas River near Dodge, Kans., 1902–1906.
Arkansas River near Hutchinson, Kans., 1895–1905.
Arkansas River near Arkansas City, Kans., 1902–1906.
Tennessee Fork near Leadville, Colo., 1890; 1903; 1911–
Lake Fork of Arkansas River near Arkansas Junction, Colo., 1890; 1903.
Half Moon Creek near Leadville, Colo., 1911–
Lake Creek near Twin Lakes, Colo., 1899–1900.
Twin Lakes outlet near Twin Lakes, Colo., 1910.
Clear Creek near Granite, Colo., 1890; 1910.
Cottonwood Creek near Buena Vista, Colo., 1890.
Cottonwood Creek at Hot Springs tunnel, near Buena Vista, Colo., 1910–11.
Cottonwood Creek below Hot Springs, near Buena Vista, Colo., 1911–
South Fork of Cottonwood Creek near Buena Vista, Colo., 1890.
North Fork of Cottonwood Creek near Buena Vista, Colo., 1911–
Chalk Creek near Buena Vista, Colo., 1910.
Chalk Creek near St. Elmo, Colo., 1911–
Grape Creek near Canon City, Colo., 1907–1909.
South Fork of Arkansas River at Poncha, Colo., 1911–
Poncha Creek at Poncha, Colo., 1911–
Oil or Fourmile Creek near Canon City, Colo., 1910.
West Beaver Creek near Victor, Colo., 1905–
Huerfano River at Badito, Colo., 1912.
Huerfano River near Undercliffe, Colo., 1908.
Cucharas River at Walsenburg, Colo., 1907–8.
Purgatory River at Trinidad, Colo., 1896–1899; 1905–1912.
Purgatory River near canyon entrance (Alfalfa), Colo., 1905–1907.
Purgatory River at J. J. ranch near La Junta, Colo., 1898.
Purgatory River near Las Animas, Colo., 1889 and 1909.
Big Sandy Creek at Hugo, Colo., 1910–1912.
Big Sandy Creek near Kit Carson, Colo., 1910–1912.
Big Spring Creek near Arena, Colo., 1910–1912.
Walnut River near Arkansas City, Kans., 1902–3.
Salt Fork of Arkansas River near Alva, Okla., 1904–5.
Salt Fork of Arkansas River near Tonkawa, Okla., 1903–1905.
Medicine River near Kiowa, Kans., 1895–96.
Cimarron River near Arkalon, Kans., 1895–96; 1903–1905.
Cimarron River near Kenton, Okla., 1904–5.

Arkansas River tributaries—Continued.
Cimarron River near Garrett, Okla., 1905–1907.
Cimarron River near Waynoka, Okla., 1903–1905.
Verdigris River near Independence, Kans., 1904.
Verdigris River near Liberty, Kans., 1895–1903.
Verdigris River near Catoosa, Okla., 1903–1905.
Fall River near Fall River, Kans., 1904–5.
Neosho River near Neosho Rapids, Kans., 1904.
Neosho River near Iola, Kans., 1895–1903.
Neosho River near Humboldt, Kans., 1904.
Neosho River (or Grand River) near Fort Gibson, Okla., 1899; 1903–1905.
Canadian River near Sanchez, N. Mex., 1912–
Canadian River at Logan, N. Mex., 1904–5; 1908–
Canadian River at Calvin, Okla., 1904–1908.
Chicorica Creek near Raton, N. Mex., 1910–
Una del Gato Creek near Raton, N. Mex., 1910–
Cimarron River at Ute Park, N. Mex., 1907–
Cimarron River at Springer, N. Mex., 1907–1909.
Rayado River near Cimarron, N. Mex., 1911; 1913–
Rayado River above Abreu's ranch, near Cimarron, N. Mex., 1908–
Rayado River below Abreu's ranch, near Cimmaron, N. Mex., 1912–
Rayado River near Springer, N. Mex., 1907–1909.
Urraca River near Cimmaron, N. Mex., 1912–
Pajarito Creek near Hanley, N. Mex., 1911–
Mora River and La Cueva canal at La Cueva, N. Mex., 1903–1911.
Mora River near Weber, N. Mex., 1903–4.
Mora River near Watrous, N. Mex., 1894–1896.
Sapello River at Sapello, N. Mex., 1903–4.
Sapello Mill tailrace at Sapello, N. Mex., 1903–4.
Sapello River at Los Alamos, N. Mex., 1903–1911.
Manuelitos River near Sapello, N. Mex., 1903–4.
Ute Creek near Logan, N. Mex., 1904–1906; 1909–
Beaver Creek at Beaver, Okla., 1904–5.
North Fork of Canadian River near Woodward, Okla., 1903–1906.
North Fork of Canadian River near El Reno, Okla., 1902–1908.
North Fork of Canadian River near Oklahoma, Okla., 1899.
North Fork of Canadian River near Eufaula, Okla., 1899.

ARKANSAS RIVER CANALS.

Oxford Farmers canal near Nepesta, Colo., 1902–3.
Colorado-Kansas canal near Prowers, Colo., 1903.
Keese ditch near Prowers, Colo., 1903.

YAZOO RIVER BASIN.

Tallahatchie River at Batesville, Miss., 1906–1912.
Tallahatchie River at Phillip, Miss., 1908–1913.
Yazoo River at Greenwood, Miss., 1908–1913.
Yazoo River at Yazoo City, Miss., 1900–1905.
Coldwater River at Savage, Miss., 1908–1912.
Yalobusha River at Grenada, Miss., 1906; 1908–1912.
Sunflower River near Ruleville, Miss., 1909–1912.
Sunflower River at Baird, Miss., 1908–1912.

HOMOCHITTO RIVER BASIN.

Homochitto River at Rosetta, Miss., 1906.

RED RIVER BASIN.

Red River at Arthur City, Tex., 1905–1911.
Salt Fork of Red River at Mangum, Okla., 1905–6.
Turkey Creek at Olustee, Okla., 1905–1908.
North Fork of Red River near Granite, Okla., 1903–1908.
North Fork of Red River near Snyder, Okla., 1905.
North Fork of Red River near Headrick, Okla., 1905–1908.
Elm Fork of Red River near Mangum, Okla., 1905–1908.
Elk Creek near Hobart, Okla., 1904–1908.
Otter Creek near Mountain Park, Okla., 1903–1908.
Horse Creek near Mountain Park, Okla., 1905–6.
Dry Fork of Otter Creek near Mountain Park, Okla, 1905–6.
Medicine Bluff Creek near Lawton, Okla., 1912–
Little Medicine Bluff Creek near Lawton, Okla., 1912–
Wichita River at Wichita Falls, Tex., 1910–11.
Washita River near Anadarko, Okla., 1902–1908.
Washita River near Pauls Valley, Okla., 1899.
Ouachita River near Malvern, Ark., 1903–1905.
Ouachita River near Arkadelphia, Ark., 1905–6.

REPORTS ON WATER RESOURCES OF THE LOWER MISSISSIPPI RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*5. Irrigation practice on the Great Plains, by E. B. Cowgill. 1897. 39 pp., 12 pls.

Describes reservoirs for storm and pumped waters, ditching, methods of distributing water, cultivation and subirrigation, duty of water, and winter irrigation.

*6. Underground waters of southwestern Kansas, by Erasmus Haworth. 1897. 65 pp., 12 pls.

Describes physiography, drainage, geologic formation and water supply, and irrigation development in Meade, Dodge, and Garden quadrangles, including all of Meade County, nearly all of Seward, Haskell, and Gray counties, about one-third of Ford County, and one-fourth of Finney County; discusses waters of Dakota sandstone, and of the Tertiary formations.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls.

Describes the location and construction of various types of canals for irrigation.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River drainage and irrigation, and gives records of stream flow.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Contains notes on early floods in Mississippi Valley.

101. Underground water of southern Louisiana, by G. D. Harris, with discussions of their uses for water supplies and for rice irrigation, by M. L. Fuller. 1904. 98 pp., 11 pls. 20c.

Discusses the topography and stratigraphic geology of the area and the origin of the well waters, gives statistics of artesian wells, describes methods of well drilling and pumping, and treats briefly of rice cultivation.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.

Contains brief reports on springs and wells of Arkansas and Missouri. The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, materials penetrated, temperature, use, and quality; many miscellaneous analyses.

105. The water powers of Texas, by T. U. Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé of the available data regarding water powers and briefly describes the principal streams, including Red and Canadian rivers.

*107. Water powers of Alabama, with an appendix on stream measurements in Mississippi, by B. M. Hall. 1904. 253 pp. 9 pls. 20c.

Appendix contains gage heights, rating tables, estimates of monthly discharge of Yazoo River.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge, 1905. 211 pp., 5 pls. 10c.

Contains a "Summary of the water supply of the Ozark region in northern Arkansas, by George I. Adams"; describes the drainage and some of the immense springs of the area, many of which have been developed as resorts.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief reports as follows:
Mississippi, by L. C. Johnson.
Louisiana and southern Arkansas, by A. C. Veatch.
Northern Arkansas, by A. H. Purdue.
Each of these reports discusses the geologic formation as related to water supply, treats particularly of the mineral waters, and gives a list of the principal publications.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains five short reports relating to areas draining to the lower Mississippi River:
Water resources of the Joplin district, Missouri-Kansas, by W. S. Tangier Smith. Describes topography, geology, streams, springs, and wells; gives analyses of waters.
Water resources of the Winslow quadrangle, Arkansas, by A. H. Purdue. Area includes a few square miles of Oklahoma, discusses water-bearing formation and the quality of spring and well waters.
Notes on certain hot springs of the southern United States, by Walter Harvey Weed. Gives an account of the history, topography, geology, flow, temperature, and composition of the Hot Springs of Arkansas, including many analyses.
Notes on certain large springs of the Ozark region, Missouri and Arkansas, compiled by Myron L. Fuller. Treats briefly of the conditions under which the springs emerge, and of their flow, temperature, and quality.
Water resources of the contact region between the Paleozoic and Mississippi embayment deposits in northern Arkansas, by A. H. Purdue. Describes geology and water resources of a belt 12 to 15 miles wide extending along the western edge of the Mississippi embayment deposits from Arkansas River northward to the Missouri line. Considers source of water, amount, chemical character and use of water, prospects for flowing wells, etc.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 15c.

Kansas floods, by E. C. Murphy. Describes floods on Kansas, Neosho, Verdigris, Osage, Arkansas, Canadian, and Purgatory rivers, discussing the streams, precipitation, damages, prevention of future damage, etc.

*148. Geology and water resources of Oklahoma, by C. N. Gould. 1905. 178 pp. 20c.

Describes topography, geology, climate, streams, springs, deep wells (water and oil and gas), and artesian water, and discusses the water supply by counties; treats of irrigation from reservoirs, springs, and wells; gives analyses of well waters and table of well records.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*153. The underflow in Arkansas Valley in western Kansas, by C. S. Slichter. 1906. 90 pp., 3 pls. 15c.

Discusses origin and extent of the underflow, fluctuations of ground water level, the chemical composition of the waters (including analyses); gives results of measurements at various points and summaries and details of pumping tests.

*154. The geology and water resources of the eastern portion of the Panhandle of of Texas, by C. N. Gould. 1906. 64 pp., 15 pls. 10c.

Discusses topography, geology, streams, springs, ground waters, and irrigation; gives details by counties.

159. Summary of the underground-water resources of Mississippi, by A. F. Crider and L. C. Johnson. 1906. 86 pp., 6 pls. 20c.

Describes geography, topography, and general geology of the State; discusses the source, depth of penetration, rate of percolation, and recovery of underground waters, artesian requisites, and special conditions in the coastal plain formations; gives notes on wells by counties, deep-well records, and selected records in details; treats of sanitary aspect of wells and gives analyses.

*160. Underground-water papers. 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Contains brief report entitled "Drainage of wet lands in Arkansas by wells," by A. F. Crider.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives account of flood on Purgatory River, Colo., and estimates of flood flow and discharge of Arkansas River at Pueblo, Colo.; contains also index to literature on flood flow in American streams.

*164. Underground waters of Tennessee and Kentucky west of Tennessee River and of adjacent area in Illinois, by L. C. Glenn. 1906. 173 pp., 7 pls. 25c.

Describes physical features, static level, and uses of waters, artesian conditions, and source properties of underground water; discusses topography, geology, and water resources by counties; gives logs of wells, analyses of waters, bibliography of most important reports.

*191. Geology and water resources of the western portion of the Panhandle of Texas, by C. N. Gould. 1907. 70 pp., 7 pls. 15c.

Describes the topography and general geology of the area, the deep-seated waters, springs, and streams, and the use of the waters for irrigation; discusses details of topography, geology, and water supply by counties.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties; gives statistics of city water supplies, analyses of waters, and many well records.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Mississippi, Arkansas, and Red Rivers.

273. Quality of the water supplies of Kansas, by H. N. Parker, with a preliminary report on stream pollution by mine waters, in southeastern Kansas, by E. H. S. Bailey. 1911. 375 pp., 1 pl. 30c.

Describes the topographic and geologic features of the State and the artesian basins; discusses the significance of mineral constituents and classification of waters; gives details concerning quality of underground water by counties and surface water by drainage basins.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and method of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of samples of water from Sapello River, Salt, North, and Elm forks of Red River, and Turkey Creek.

276. Geology and underground waters of northeastern Texas, by C. H. Gordon. 1911. 78 pp., 2 pls. 10c.

Describes geography, physiography, and geology of area comprising Bowie, Red River, Lama, Delta, Hopkins, Franklin, Titus, Morris, Camp, and Cass counties; discusses the source and availability of underground waters, artesian waters of the various formations, and reviews the geographic relations, geology, and water resources by counties.

*317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls. 10c.

Describes the physiography, climate, surface and deep waters of an area in Montague, Clay, Wichita, Wilbarger, Hardeman, Foard, Knox, Baylor, Archer, Jack, Young, Throckmorton, and Haskell counties; gives details by counties.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, fields and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. *Pt. II. Irrigation, pp. xiv, 395, 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, pp. xviii, 576; 93 plates. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites in Chaffee, Custer, Fremont, Park, El Paso, Pueblo, Huerfano, Las Animas, Bent, Otero, Baca, Kiowa, and Lake counties, Colo.; for each reservoir site gives the location, height of dam, areas inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin Basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III. Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

*Engineering results of irrigation survey by H. M. Wilson, pp. 351–437, Pls. CXLVII–CLXXXII. Describes the engineering work at Twin Lakes reservoir and Twin Lakes dam, Colorado.

*Report upon the construction of topographic maps and the selection and survey of reservoir sites in the hydrographic basin of the Arkansas River, Colo., by A. H. Thompson, pp. 429–444. Scope indicated by title.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

*The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Seventeenth Annual Report of the United States Geological Survey, 1895–96, Charles D. Walcott, Director. 1896. 3 parts in 4 vols. *Pt. II. Economic geology and hydrography, xxv, 864 pp., 113 pls. $2.35. Contains:

The underground water of the Arkansas Valley in eastern Colorado, by G. K. Gilbert, pp. 561–601, Pls. LVI–LXVIII. Describes the geology and topography of the district, the general conditions under which artesian water occurs, the gathering grounds, capacity, distribution, and quality of the water of the Dakota sandstone, the water of the upland sands, the terraces, and the dune sands, and the underflow of rivers and creeks.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, pp. 768, 156 pls. $2.35. Contains:

* The High Plains and their utilization, by W. D. Johnson, pp. 601–741, Pls. CXIII–CLVI. Describes the area lying in an irregular belt lying about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Platte, Republican, and Smoky Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of the High Plains, the precipitation, temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report, Pt. IV, pp. 631–669, Pls. LI–LXV. ($2.20.)

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records

of wells in Arkansas, Colorado, New Mexico, Oklahoma, Kansas, Missouri, Tennessee, and Texas, and detailed records of wells in Otero County, Colo.; Greenwood, Montgomery, and Neosho counties, Kans.; and St. Louis County, Mo. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arkansas, Colorado, Kansas, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, Tennessee, and Texas; and detailed records of wells in Hempstead County, Ark.; Fremont and Pueblo counties, Colo.; Allen, Chase, Coffey, and McPherson counties, Kans.; Panola County, Miss.; Nowata, Washington, Tulsa, Murray, Okmulgee, and Pawnee counties, Okla.; and Clay and Roberts counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

PROFESSIONAL PAPERS.

Professional papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked with an asterisk may, however, be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Professional papers are of quarto size.

*32. Geology and underground water resources of the central Great Plains, by N. H. Darton. 1905. 433 pp., 72 pls. $1.80.

Describes altitudes and slopes, climate, drainage, stratigraphic structure, historical geology, and the water horizons; discusses deep wells and prospects (by counties and towns) in South Dakota (see Water-Supply Paper 227), Nebraska, central and western Kansas, eastern Colorado, and eastern Wyoming; discusses also the occurrence of coal, petroleum, and natural gas, salt, gypsum, gold, iron ore, and other minerals.

*46. Geology and underground water resources of northern and southern Arkansas, by A. C. Veatch. 1906. 422 pp., 51 pls. $1.50.

Describes the historical geology and topographic development of a portion of the Coastal Plain; discusses the fundamental principles governing underground waters and their application to this region; contains account of methods and costs of well making, gives well predictions and a short discussion of the underground conditions in each county, and data in regard to wells arranged in tables by counties, followed by notes giving sections, analyses of waters, etc.; contains also a dictionary of altitudes, arranged by counties.

*52. Geology and underground waters of Arkansas Valley in eastern Colorado, by N. H. Darton. 1906. 90 pp., 28 pls.

Describes the stratigraphic, structural, and historical geology of the Arkansas Valley and the relation of the geologic formations to the underground waters; discusses the source, depths, areas of flow, head, quantity, and quality of the waters of the "Dakota" sandstone, and the waters of the Red Beds and Morrison formations, the Laramie and associated formations, the later Tertiary deposits, and the dune sands. "An extension of the preliminary examination of the region by G. K. Gilbert in 1894 and 1895." See Seventeenth Annual Report, part 2, 1896, pp. 1–51.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and val-

[1] Index maps showing areas in the lower Mississippi River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

leys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

36. Pueblo, Colorado.

Describes the general geography and geology of the area and the relations of geologic formations to underground waters.

58. Elmoro, Colorado.

Describes the geography and general geology of the area and, under "Economic geology," discusses the artesian water of the Dakota formation.

68. Walsenburg, Colorado.

Describes the geography and general geology of the area and, under "Economic geology," the artesian waters.

*71. Spanish Peaks, Colorado.

Describes the topography and drainage of area in Las Animas and Huerfano counties, Colorado, discusses the general geology and the rocks, and, under "Economic geology," the artesian waters of the area.

122. Tahlequah, Oklahoma-Arkansas.

Describes the physiographic relations of the Ozark region in the Arkansas Valley, the topography and the stratigraphic and structural geology of the Tahlequah quadrangle, and, under "Economic geology," gives a brief account of the springs and underground waters.

132. Muscogee, Oklahoma.

Describes the relief and drainage of the Muscogee quadrangle, and the stratigraphic, structural, and historical geology, and, under "Mineral resources," discusses springs, wells, and surface waters.

135. Nepesta, Colorado.

Describes relief and drainage of the Nepesta quadrangle, the stratigraphic, structural, and historical geology, and, under "Economic geology," the surface and underground waters; discusses the source, head, and chemical properties of the artesian waters, gives records of deep borings, and treats briefly on irrigation by ditches from Arkansas River; gives analyses of water from wells at Pueblo and from a spring at Fowler.

148. Joplin district, Missouri-Kansas.[a]

Describes the topography, drainage, and geology of the Joplin district and, under "Economic geology," discusses the water power of Spring River, Shoal Creek, and Center Creek, the municipal water supplies of Carthage, Webb City, Joplin, and Galena, and the dug wells and springs of the country districts, and artesian wells.

MISCELLANEOUS REPORTS.

Other Federal bureaus, State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the lower Mississippi River drainage basin are the reports of the State geologists of Kansas, Tennessee, Louisiana, and Texas, the Mississippi Agricultural Experiment Station, the Chief of Engineers, United States Army, the Mississippi River Commission, and the Tenth Census, volume 17. The following reports deserve special mention:

Special report on well waters in Kansas, by Erasmus Haworth, State geologist: Kansas Univ. Geol. Survey Bull. 1, 1913.

Report of the Board of Irrigation Survey and Experiment for 1895 and 1896 to the Legislature of Kansas, 1897.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch, and others: Louisiana Geol. Survey Bull. 1, 1905.

Geology and underground water resources of northern Louisiana, with notes on adjoining districts, by A. C. Veatch: Louisiana Geol. Survey Bull. 4, 1906.

Report on water purification investigation and of plans proposed for sewerage waterworks systems: New Orleans Sewerage and Water Board, 1903.

Water powers of Arkansas: A preliminary report on White River and some of its tributaries, by W. N. Gladson. 1911.

Preliminary report on drainage of lands overflowed by the North and Middle forks of Forked Deer River and Rutherford Fork of Obion River in Gibson County, Tenn., by A. E. Morgan and S. H. McCrory: Tennessee Geol. Survey Bull. 3-B, 1910.

The delta of the Mississippi: The physics of the river, the control of its floods, and the redemption of the alluvion, by Col. Caleb G. Forshey, Cambridge, 1873.

Report on the physics and hydraulics of the Mississippi River, by A. A. Humphreys and H. L. Abbot: Prof. Papers Corps Top. Eng. U. S. Army, No. 4, 1861.

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[a] Reprinted; price 50c.

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Part VIII. WESTERN GULF OF MEXICO DRAINAGE BASINS.

PRINCIPAL STREAMS.

The western Gulf of Mexico drainage basins include all streams draining into the Gulf of Mexico west of the mouth of the Mississippi and into the Rio Grande. The largest streams flowing into the Gulf of Mexico above the mouth of the Rio Grande are Sabine, Trinity, and Brazos rivers, Colorado River of Texas, and Guadalupe River. The principal tributaries of the Rio Grande are Chama River, Rio Puerco, and Pecos River in the United States and Rio Salado and Rio San Juan in Mexico. The streams drain wholly or in part the States of Colorado, Louisiana, New Mexico, Texas, and northern States of Mexico.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 104.)

GAGING STATIONS.

Note.—Dash after a date indicates that station was being maintained June 30, 1913; period after a date indicates discontinuance.

SABINE RIVER BASIN.

Sabine River near Longview, Tex., 1904–1906.
Sabine River at Logansport, La., 1903–1906.
Neches River at Evadale, Tex., 1904–1906.

TRINITY RIVER BASIN.

Trinity River at Dallas, Tex., 1898–99; 1903–1906.
Trinity River at Riverside, Tex., 1903–1906.

BRAZOS RIVER BASIN.

Brazos River at Waco, Tex., 1898–1911.
Brazos River near Lewis (Hearne), Tex., 1898–99.
Brazos River at Richmond, Tex., 1903–1906.

COLORADO RIVER (OF TEXAS) BASIN.

Colorado River at Austin, Tex., 1895–1911.
Colorado River at Columbus, Tex., 1903–1911.
San Saba River near San Saba, Tex., 1905–

GUADALUPE RIVER BASIN.

Guadalupe River near New Braunfels, Tex., 1898–99.
Guadalupe River near Cuero, Tex., 1903–1906.

RIO GRANDE BASIN.

Rio Grande at Thirtymile Bridge near Creede, Colo., 1909–
Rio Grande near Creede (Wason), Colo., 1907–
Rio Grande near Del Norte, Colo. (except 1907), 1889–
Rio Grande near Alamosa, Colo., 1894–5; 1903; 1912–
Rio Grande near Lobatos (Cenicero), Colo., 1899–
Rio Grande near Embudo, N. Mex., 1889–1903; 1912–
Rio Grande near Buckman, N. Mex. (Rio Grande near Ildefonso), 1895–1905; 1909–
Rio Grande near San Marcial, N. Mex., 1895–
Rio Grande near El Paso, Tex., 1889–1893; 1895–
Rio Grande near Fort Hancock, Tex., 1900–1903.
Rio Grande above Presidio, Tex., 1900–
Rio Grande below Presidio, Tex., 1900–
Rio Grande near Langtry, Tex., 1900–
Rio Grande near Devils River, Tex., 1900–
Rio Grande at Eagle Pass, Tex., 1900–
Rio Grande near Laredo, Tex., 1900–
Rio Grande near Roma, Tex., 1900–
Rio Grande near Brownsville, Tex., 1900–
Clear Creek near Creede, Colo., 1910.
South Fork of Rio Grande at South Fork, Colo., 1910–
San Luis Creek at Villa Grove, Colo., 1911–12.
San Luis Creek near Villa Grove, Colo., 1910–
Kerber Creek near Villa Grove, Colo., 1911–12.
Saguache River near Saguache, Colo., 1910–
Rio Alamosa near Monte Vista, Colo., 1911–12.
Rio Alamosa near La Jara, Colo., 1909–1912.
Conejos River near Mogote, Colo., 1899–1900; 1905–
Culebra River at San Luis, Colo., 1910–11.
Rio San Antonio near Ortiz, N. Mex., 1911.
Costilla Creek near mouth, N. Mex., 1912.
Rio Colorado above Questa, N. Mex., 1910–11.
Rio Colorado near Questa, N. Mex., 1912–
Rio Colorado below Questa, N. Mex., 1910–
Rio Hondo near Arroyo Hondo, N. Mex., 1910–
Rio Pueblo de Taos near Taos, N. Mex., 1910–
Rio Taos at Los Cordovas, N. Mex., 1910–
Rio Lucero near Taos, N. Mex., 1910–
Rio Fernando de Taos near Taos, N. Mex., 1910–
Chama River at Chama, N. Mex., 1912–
Chama River at Parkview, N. Mex., 1912–
Chama River near Abiquiu, N. Mex., 1895–1897.
Chama River near Chamita, N. Mex., 1912–
Brazos River at Brazos, N. Mex., 1912–1913.
Horn River near Canjilon, N. Mex., 1911–
Rio Vallecitos at Vallecitos, N. Mex., 1911–
Santa Fe Creek at Monument Rock, near Santa Fe, N. Mex., 1910–11.
Santa Fe Creek above reservoir, near Santa Fe, N. Mex., 1910; 1913–

Rio Grande tributaries—Continued.
Santa Fe Creek at Santa Fe, N. Mex., 1907–1911.
Santa Fe Water & Light Co.'s ditch near Santa Fe, N. Mex., 1910.
Arroyo Hondo near Santa Fe, N. Mex., 1913–
Rio Puerco at Rio Puerco, N. Mex., 1910–
Rio Puerco near La Joya, N. Mex., 1910–
Bluewater Creek (head of San Jose River) near Bluewater, N. Mex., 1912–
Bluewater Creek at Grants, N. Mex., 1912–
San Jose River near Suwanee, N. Mex., 1910–
Pecos River near Cowles, N. Mex., 1910–
Pecos River near Anton Chico, N. Mex., 1910–
Pecos River at Santa Rosa, N. Mex., 1903–1906; 1910–
Pecos River near Guadalupe, N. Mex., 1912–
Pecos River near Fort Sumner, N. Mex., 1904–1910; 1912–13.
Pecos River near Roswell, N. Mex., 1903–1906.
Pecos River near Dayton, N. Mex., 1905–
Pecos River near Lakewood, N. Mex., 1906–1911.
Pecos River at Avalon, N. Mex., 1906–7.
Pecos River at Carlsbad, N. Mex., 1903–1908.
Pecos River near Pecos, Tex., 1898–1907.
Margueretta flume near Pecos, Tex., 1898; 1900–1908.
West Valley ditch near Pecos, Tex., 1904.
Pecos River near Moorhead, Tex., 1898; 1900–
Gallinas River near Las Vegas, N. Mex., 1903–
South Fork of Gallinas River near El Porvenir, N. Mex., 1911–
Taylor Moore ditch near Roswell, N. Mex., 1905.
Hondo River at Hondo Reservoir, N. Mex., 1903–1906.
Hondo reservoir inlet near Roswell, N. Mex., 1906–1908.
Hondo reservoir scour gate near Hondo Reservoir, N. Mex., 1906.
Hondo River at Roswell, N. Mex., 1903–1906.
Rio Ruidoso near Ruidoso, N. Mex., 1911.
Rio Ruidoso near Glencoe, N. Mex., 1910–11.
Penasco River at Elk, N. Mex., 1910–11.
Penasco River at Cleve's ranch, near Elk, N. Mex., 1911.
Penasco River near Dayton, N. Mex., 1905–1908.
Lake McMillan at Lakewood, N. Mex., 1906–7.
Delaware River near Malaga, N. Mex., 1912–13.
Devils River at Devils River, Tex., 1900–1914.
Rio Salado near Guerrero, Tamaulipas, Mex., 1900–
Rio San Juan at La Quemada, Tamaulipas, Mex., 1900–1902.
Rio San Juan near Santa Rosalia ranch, Tamauilpas, Mex., 1902–

INTERIOR BASINS IN NEW MEXICO.

Mimbres River basin:
Mimbres River near Faywood, N. Mex., 1908–
Lampbright Draw near Santa Rita, N. Mex., 1912–
Whitewater Draw near Hurley, N. Mex., 1913–
Cameron Creek at Fort Bayard, N. Mex., 1907–1911; 1912–
Stevens Creek near Fort Bayard, N. Mex., 1907–1911; 1912–
Rio Tularosa basin:
Rio Tularosa at Mescalero, N. Mex., 1910–11.
Rio Tularosa near Bent, N. Mex., 1911–12.
Rio Tularosa near Tularosa, N. Mex., 1912–

Rio La Luz basin:
Rio La Luz near La Luz, N. Mex., 1911–12.
Rio La Luz at La Luz, N. Mex., 1910–1913.
Rio Fresnal near Mountain Park, N. Mex., 1911–12.

REPORTS ON WATER RESOURCES OF THE WESTERN GULF STATES.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*10. Irrigation in Mesilla Valley, N. Mex., by F. C. Barker. 1898. 51 pp., 11 pls.

Describes primitive methods of irrigation and agriculture employed in an area lying along both sides of the Rio Grande, extending from Fort Seldon, N. Mex., on the north, to within 3 miles of El Paso on the south. Chiefly of historic interest.

*13. Irrigation systems in Texas, by W. F. Huston. 1898. 68 pp., 10 pls.

Discusses climate, rainfall, irrigation works and projects in Texas; considers use of both surface and underground waters.

40. The Austin dam, by T. U. Taylor. 1900. 51 pp., 16 pls. 15c.

Describes preliminary projects, construction, economic aspects, and failure of the dam across Colorado River.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (p. v.). 5c.

71. Irrigation systems of Texas, by T. U. Taylor, 1902. 137 pp., 9 pls. 10c.

Discusses principal irrigation systems in geographic order and gives statistics as to the location, cost, and benefits of the devices for obtaining water; describes rice irrigation systems, and appends a brief statement of laws governing irrigation in the State.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses, under South Platte, Arkansas, Rio Grande, San Juan, Grand, and Green River irrigation divisions, drainage and irrigation and gives records of stream flow.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.]

Contains "Investigations in Pecos Valley," by W. M. Reed.

101. Underground waters of southern Louisiana, by G. D. Harris, with discussions of their uses for water supplies and for rice irrigation, by M. L. Fuller. 1904. 98 pp., 11 pls. 20c.

Discusses the topography and stratigraphic geology of the area and the origin of the well waters, gives statistics of artesian wells, describes methods of well drilling and pumping and treats briefly of rice cultivation.

105. The water powers of Texas, by T. U. Taylor. 1904. 116 pp., 17 pls. 15c.

Gives a résumé of the available data regarding water powers and briefly describes the principal streams.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains brief report on Louisiana and southern Arkansas; discusses the geologic formation as related to water supply; treats particularly of the mineral waters, and gives a list of the principal publications.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Contains a chapter giving results of tests of typical pumping plants in the Rio Grande valley in Texas and New Mexico.

141. Observations on the ground waters of the Rio Grande valley, by C. S. Slichter. 1905. 83 pp., 5 pls. 5c.

Describes investigation of the underflow in the valley of the Rio Grande in Texas and New Mexico, gives details of tests of pumping plants near El Paso, Tex., in Mesilla Valley, N. Mex., and near Berino, N. Mex., and analyses of well waters and data concerning wells at and near El Paso.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 206 pp., 18 pls. 15c. Contains:

Pecos River basin flood, New Mexico, from report of Frank S. Dobson.
Failures of Lake Avalon dam near Carlsbad, N. Mex., by E. C. Murphy.
Rio Grande floods, New Mexico, by E. C. Murphy.

158. Preliminary report on the geology and underground waters of the Roswell artesian area, New Mexico, by C. A. Fisher. 1906. 22 pp., 9 pls. 15c.

Discusses topography and geology of a belt lying along Pecos River from Roswell to Lake McMillan; discusses area and extent of artesian basins, source, amount, pressure, quality (with analyses), and waste of artesian waters, and irrigation; lists typical wells and gives well records.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index of flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives accounts of floods on Pecos and Hondo Rivers and the Rio Grande and estimates of flood frequency and discharge for Rio Grande at San Marcial, N. Mex., and Colorado River (Texas) at Austin; contains also index to literature on floods on American streams.

*188. Water resources in the Rio Grande valley, New Mexico, and their development, by W. T. Lee. 1907. 59 pp., 10 pls. 20c.

Describes the physical features of the valley, rock formation and structure, the Engle, San Acaci, San Felipe, and Espanola reservoir sites, surface and underground waters by districts, the origin, course, and quantity of the underflow, the chemical character of the water in the Mesilla and other districts, and the utilization of the underflow by wells and seepage ditches.

*190. Underground waters of the Coastal Plain of Texas, by Thomas U. Taylor. 15c.

Describes topography, drainage, and geology, and discusses the underground waters by counties; gives many well records and analyses.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Brazos and Colorado (of Texas) Rivers and the Rio Grande.

240. Geology and water resources of the San Luis Valley, Colorado, by C. E. Siebenthal. 1910. 128 pp., 13 pls. 25c.

Describes the topography, drainage, climate, geologic features, flowing and nonflowing wells, springs, the grouping of wells, and variations in flow and temperature, and the quality (with analyses) and uses of the water; discusses briefly well-drilling methods and costs, and approximate measurements of flows.

260. Preliminary report on the ground waters of Estancia Valley, New Mexico, by O. E. Meinzer. 1910. 33 pp. 5c. (See Water-Supply Paper 275.)

Discusses briefly the geographic relation and industrial development, geology, and soils; discusses the source, disposal, recovery and quality, and utilization of the ground waters, cost of pumping, windmills, value of crops, and the alkali problem.

274. Some stream waters of the Western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

275. Geology and water resources of Estancia Valley, New Mexico, with notes on ground-water conditions in adjacent parts of central New Mexico, by O. E. Meinzer. 1911. 89 pp., 14 pls. 20c.

Describes physiographic features and geologic formations, soils and climate; discusses the source and disposal of the water supply, the head of the water supply, artesian conditions, yield of wells and quantity of water available, the quality of the water (dissolved solids, chlorine, sulphates, carbonates, and bicarbonates), the storage of storm water, the present and future use of ground water for irrigation, proper types of wells, windmills, cost of pumping, value of crops, and the alkali problem; tables give depth to water and field assays. Contains also brief reports on physiography, geology, soil, ground water, and irrigation in Encino and Pinos Wells basins.

*317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls. 10c.

Describes the physiography, climate, surface, and deep waters of an area in Montague, Clay, Wichita, Wilbarger, Hardeman, Foard, Knox, Baylor, Archer, Jack, Young, Throckmorton, and Haskell counties; gives details by counties.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II, Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, pp. xiv, 395, 30 pls. and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

Eleventh Annual Report of the United States Geological Survey—Continued.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites in Rio Arriba, Taos, Santa Fe, Bernalillo, Mora, San Miguel, Valencia, Socorro, and Sierra counties, New Mexico, and on tributaries of the Rio Grande; for each reservoir site gives the location, height of dam, areas inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, Pls. CXLVII–CLXXXII. Discusses surveys, flood-water storage, dam site, estimated cost of El Paso reservoir, Texas.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II, Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

*The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. * Pt. II, papers chiefly of a theoretic nature, p. v, 653, 105 pls. $1.65. Contains:

*Geology of portions of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Texas, with especial reference to the occurrence of artesian and other underground waters, by R. T Hill and T. W. Vaughan, pp. 193, 322, Pls. XXI–LXIV. Discusses the general principles of artesian waters, the capacity of the various rock sheets for water, the nonflowing wells, the gravity springs, and artesian wells of the Edwards

Eighteenth Annual Report of the United States Geological Survey—Continued.
Plateau and Rio Grande Plain; the probable identity of source of artesian and fissure spring waters, and the availability and limitations of underground waters; treats of the chemical quality of the artesian well waters, and gives analyses of waters from the various beds and of spring waters from Austin and vicinity.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols., and separate case for maps with Pt. V. *Pt. IV, Hydrography, pp. 768, 156 pls. $2.35. Contains:

*The High Plains and their utilization, by W. D. Johnson, pp. 601–741, Pls. CXIII–CLVI. Describes the area lying in an irregular belt lying about midway across the long eastward slope of the Great Plains and including parts of Wyoming, Colorado, and Nebraska (North and South Platte, Platte, Republican, and Smoky Hill River basins), Colorado, Kansas, New Mexico, Oklahoma, and Texas (Arkansas River basin), and Colorado, New Mexico, and Texas (Rio Grande basin); discusses the origin and structure of the High Plains, the precipitation, temperature, and other factors of climate, experiments with irrigation, and the use of mountain streams, local storm-water storage, and artesian waters. Concluded in the Twenty-second Annual Report.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Pts. III and IV, 1902.) 4 parts. Pt. IV, Hydrography, pp. 631–669, Pls. LI–LXV. $2.20. Contains:

Conclusion of The High Plains and their utilization.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

264. Records of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated records of wells in Colorado, Louisiana, New Mexico, and Texas, and detailed record of well near Houston, Harris County, Tex. This well was selected because it affords definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Colorado, Louisiana, New Mexico, and Texas; and detailed records of wells in Eddy and Torrance counties, New Mexico; and Bexar, Cameron, Coleman, Dallas, Dimmit, Duval, Fayette, Fort Bend, Guadalupe, Hardin, Harris, Hays, Jasper, Johnson, Kendall, Lampasas, Liberty, Medina, Navarro, Nueces, Parker, Williamson, and Zavalla counties, Tex. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of

[1] Index maps showing areas in the western Gulf of Mexico basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geological folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

42. Nueces, Texas.

Describes geography and geology, and relations of geologic formations to underground waters.

64. Uvalde, Texas.

Describes the topography and geology of the area, the streams, springs and wells, and discusses the possibility of obtaining artesian flows.

76. Austin, Texas.

Describes the topography and geology of the area, the drainage, and discusses the possibility of obtaining artesian water.

120. Silverton, Colorado.

Describes an area in the San Juan Mountains including a portion of the Continental Divide, and sending streams through Animas River to the San Juan, through Uncompahgre to the Gunnison and the Colorado, and through small creeks to the Rio Grande; includes in the discussion of the economic geology a brief study of the ground waters.

183. Llano-Burnet,[1] Texas.

Describes the relief of the Llano and Burnet quadrangles, the drainage through Colorado River (of Texas and tributaries), and tributaries of Brazos River and the geology; under "Mineral Resources" discusses rainfall, streams, springs, wells, tanks, and cisterns.

MISCELLANEOUS REPORTS.

Other Federal bureaus, State and other organizations, have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the western Gulf of Mexico drainage basins are the reports of the State geological surveys of Louisiana and Texas, the reports of the State engineers of Colorado and New Mexico, and the annual reports of the United States Reclamation Service. The following deserve special mention:

Report of commission appointed to revise the laws of the State of Colorado regulating the appropriation, distribution, and use of water. 1890.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the Chief of Engineers, together with a report of Captain Chittenden: 55th Cong., 2d sess., House Doc. 141.

Report on the underground waters of Louisiana, by G. D. Harris, A. C. Veatch and others, made under the direction of the State experiment station: Louisiana Geol. Survey Bull. 1, 1905.

Preliminary report on the soils and waters of the upper Rio Grande and Pecos Valleys in Texas, by H. H. Harrington: Texas Geol. Survey Bull. 2, 1890.

Water supply of southwestern Texas, compiled by H. M. Madison. 1912.

Artesian water on the Llano Estacado, by G. G. Shumard: Texas Geol. Survey Bull. 1, 1892.

Preliminary reports on the artesian wells of the Gulf coastal slope, by J. A. Singley, and on the organic remains from the deep well at Galveston, by Gilbert D. Harris: Texas Geol. Survey, Fourth Ann. Rept., 1892.

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[1] Issued in two editions (see p. 103). Specify edition desired.

Part IX. COLORADO RIVER BASIN.

PRINCIPAL STREAMS.

The largest tributaries of the Colorado River are Green River (considered the continuation of the main stream), Grand River, Dolores, San Juan, Little Colorado, Virgin, and Gila Rivers. The principal streams flowing into the Green are Newfork Creek, Yampa River, Ashley Creek, Duchesne River, and White River. The principal tributaries of Grand River are Grand Lake, Frazier River, Williams Fork, Blue River, and Gunnison River. The streams of the Colorado basin drain wholly or in part the States of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 116.)

GAGING STATIONS.

Note.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinuance.

Green River, (head of Colorado River) near Kendall, Wyo., 1910–1912.
Green River at Green River, Wyo., 1895–1906.
Green River near Vernal, Utah, 1903–1906.
Green River at Ouray, Utah, 1904–5; 1913–
Green River near Bridgeport, Utah. 1911–
Green River at Greenriver (formerly Blake), Utah, 1894–1899; 1905–1911.
Green River at Little Valley near Greenriver, Utah, 1910–
Colorado River at Hardyville, Ariz., 1905–1907.
Colorado River near Mohave, Ariz., 1902–3.
Colorado River at Yuma, Ariz., 1891–
Newfork Creek near Cora, Wyo., 1905; 1910–11.
Pine Creek near Pinedale, Wyo., 1905–1906; 1910–1912.
Pole Creek near Fayette, Wyo., 1904–1906.
Pole Creek near Pinedale, Wyo., 1910–1912.
Fall Creek at Fayette, Wyo., 1904–5.
Boulder Creek at Boulder (Newfork), Wyo., 1904–1906.
Eastfork River at Newfork, Wyo., 1905–6.
Black Fork of Green River at Granger, Wyo., 1896–1900.
Big Sandy Creek at Leckies ranch, near Big Sandy, Wyo., 1910–

Colorado River—Continued.
Big Sandy Creek near Eden, Wyo., 1911–
Dutch Jo Creek at Dutch Jo Ranger station, near Big Sandy, Wyo., 1911–1912.
Squaw Creek near Big Sandy, Wyo., 1911–1912.
Little Sandy Creek near Eden, Wyo., 1911–12.
Beaver Creek near Ladore, Colo., 1910–11.
Vermilion Creek near Ladore, Colo., 1910–11.
Yampa River at Yampa, Colo., 1910–
Yampa River at Steamboat Springs, Colo., 1904–1906; 1910–
Yampa River at Craig, Colo., 1901–2; 1904–1906; 1910–
Yampa River near Maybell, Colo., 1904–5; 1910–
Terrible Creek:
Trout Creek at Pinnacle, Colo., 1910–11.
Soda Creek at Steamboat Springs, Colo., 1910–1911.
Elk River at Hinman Park, Colo., 1912–
Elk River near Clark, Colo., 1910–
Elk River near Trull, Colo., 1904–1906; 1910–
Mad Creek near Steamboat Springs, Colo., 1912–
Sage Creek:
Fish Creek at Dunkley, Colo., 1910–11.
Elk Head Creek near Craig, Colo., 1906; 1910–
Fortification Creek at Craig, Colo., 1905–6; 1910–
Williams River near Pyramid, Colo., 1910–11.
Williams River at Hamilton, Colo., 1904–1906; 1910–
Milk Creek at Axial, Colo., 1904–5.
Little Snake River [Middle Fork] near Battle Creek, Colo., 1912–
Little Snake River at Dixon, Wyo., 1910–
Little Snake River near Maybell, Colo., 1904.
South Fork of Little Snake River near Battle Creek, Colo., 1912–
Slater Creek at Baxter ranch, near Slater, Colo., 1912–
Slater Creek near Slater, Colo., 1910–1912.
Beaver Creek:
Willow Creek near Baggs, Wyo., 1912–
Fourmile Creek near Baggs, Wyo., 1912–
Ashley Creek near Vernal, Utah, 1900–1904; 1911–
Dry Fork of Ashley Creek at Vernal, Utah, 1904.
North Fork of Duchesne River (head of Duchesne River), above Forks, Utah, 1904.
Duchesne River at Myton, Utah, 1899–
West Fork of Duchesne River above Forks, Utah, 1904.
Rock Creek (East Creek) 10 miles above mouth, Utah, 1904.
Strawberry River above mouth of Indian Creek, in Strawberry Valley, Utah, 1909–10.
Strawberry River below mouth of Indian Creek, in Strawberry Valley, Utah, 1903–1906; 1908–9.
Strawberry River at Theodore, Utah, 1908–1910.
Indian Creek in Strawberry Valley, Utah, 1905–6; 1909–10.
Trail Hollow Creek in Strawberry Valley, Utah, 1909–10.
Currant Creek, 13 miles above mouth, Utah, 1904.
Currant Creek, 3 miles above mouth, Utah, 1904.
Red Creek above Narrows, Utah, 1904.
West Fork of Lake Fork (head of Lake Fork), 10 miles above Forks, Utah, 1904.

Colorado River—Continued.
Duchesne River—Continued.
Lake Fork below Forks, Utah, 1904; 1907–1910.
Lake Fork near Myton, Utah, 1900–1903; 1907–
East Fork of Lake Fork, 8 miles above Forks, Utah, 1904.
Uinta River near Whiterocks, Utah, 1899–1904; 1907–1910.
Uinta River at Fort Duchesne, Utah, 1899–1904; 1906–1910.
Uinta River at Ouray School, Utah, 1899–1904.
Whiterocks River near Whiterocks, Utah, 1899–1904; 1907–1910.
North Fork of White River (head of White River) near Buford, Colo., 1903–1906; 1910–
White River at Meeker, Colo., 1901–1906; 1910–
White River at White River City, Colo., 1895.
White River at Rangely, Colo., 1904–5.
White River at Dragon, Utah, 1906.
White River at Ouray, Utah, 1904.
Marvine Creek near Buford, Colo., 1903–1906.
South Fork of White River near Buford, Colo., 1903–1906; 1910–
Price River near Helper, Utah, 1894–1895; 1904–
Price River at Woodside, Utah, 1909–1911.
San Rafael River near Greenriver, Utah, 1909–
Cottonwood Creek near Orangeville, Utah, 1909–
Ferron Creek near Ferron, Utah, 1909–1911.
Ferron Creek (upper station) near Ferron, Utah, 1911–
Ferron Creek near Castledale, Utah, 1911–
Huntington Creek near Huntington, Utah, 1909–
Huntington Creek (lower) near Castledale, Utah, 1911–
North Fork of Grand River (head of Grand River) near Grand Lake, Colo., 1904–
Grand River near Granby, Colo., 1908–1911.
Grand River at Sulphur Springs, Colo., 1904–
Grand River near Kremmling, Colo., 1904–
Grand River near Wolcott, Colo., 1906–1908.
Grand River at Shoshone, Colo., 1897.
Grand River at Glenwood Springs, Colo., 1899–
Grand River near Palisades, Colo., 1902–
Grand River near Grand Junction, Colo., 1895–1900.
Grand River near Fruita, Colo., 1911–
Grand River near Moab, Utah, 1913–
North inlet to Grand Lake at Grand Lake, Colo., 1905–1912.
Grand Lake outlet at Grand Lake, Colo., 1904–1913.
South Fork of Grand River, near Lehman, Colo., 1907–8.
Fraser River near Arrow, Colo., 1910–
Fraser River at upper station near Fraser, Colo., 1908–1911.
Fraser River at lower station near Fraser, Colo., 1907–1909.
Fraser River at Granby (Coulter), Colo., 1904–1909.
Big Jim Creek near Fraser, Colo., 1907–1909.
Little Jim Creek near Fraser, Colo., 1907–1909.
Vasquez Creek at upper station near Fraser, Colo., 1908–9.
Vasquez Creek at lower station near Fraser, Colo., 1907–1909.
Elk Creek near Fraser, Colo., 1907–1909.
St. Louis Creek at upper station near Fraser, Colo., 1908–9.
St. Louis Creek at lower station near Fraser, Colo., 1908–9.

Colorado River—Continued.
Grand River—Continued.
Fraser River—Continued.
North Ranch Creek at upper station near Rollins Pass, Colo., 1908–9.
North Ranch Creek at lower station near Rollins Pass, Colo., 1907–1909.
Middle Ranch Creek at upper station near Arrow, Colo., 1908–9.
Middle Ranch Creek at lower station near Arrow, Colo., 1907–1909.
South Ranch Creek at upper station near Arrow, Colo., 1908–9.
South Ranch Creek at lower station near Arrow, Colo., 1907–1909.
Williams Fork near Scholl, Colo., 1910–
Williams Fork near Sulphur Springs, Colo., 1904–
Troublesome Creek at Troublesome, Colo., 1904–5.
Muddy Creek at Kremmling, Colo., 1904–5.
Blue River at Dillon, Colo., 1910–
Blue River near Kremmling, Colo., 1904–1908.
Tenmile Creek near Kokomo, Colo., 1904.
Tenmile Creek near Uneva Lake, Colo., 1903.
Tenmile Creek at Dillon, Colo., 1910–
Snake River at Dillon, Colo., 1910–
Eagle River at Red Cliff, Colo., 1911–
Eagle River at Eagle, Colo., 1905–1907; 1911–
Eagle River at Gypsum, Colo., 1907–1909.
Turkey Creek at Red Cliff, Colo., 1913–
Homestake Creek at Red Cliff, Colo., 1911–
Gore Creek near Minturn, Colo., 1911–
Beaver Creek at Avon, Colo., 1911–
Brush Creek at Eagle, Colo., 1911–1913.
No Name Creek near Glenwood Springs, Colo., 1911–
Glenwood Light & Power Co.'s flume near Glenwood Springs, Colo., 1911–
Roaring Fork at Aspen, Colo., 1911–
Roaring Fork below Aspen, Colo., 1913–
Roaring Fork near Emma, Colo., 1908–9.
Roaring Fork at Glenwood Springs, Colo., 1906–
Hunter Creek at Aspen, Colo., 1911–1913.
Castle Creek near Aspen, Colo., 1911–
Maroon Creek near Aspen, Colo., 1911–
Snow Mass Creek at Snow Mass, Colo., 1911–1913.
Frying Pan Creek at Norrie, Colo., 1911–
Frying Pan Creek at Thomasville, Colo., 1911–
Frying Pan Creek at Basalt, Colo., 1908–9.
North Fork of Frying Pan Creek near Norrie, Colo., 1911–
Crystal River at Marble, Colo., 1910–
Crystal River near Carbondale (Sewell), Colo., 1908–9.
West Fork of Elk Creek (head of Elk Creek), near Newcastle, Colo., 1911.
Middle Fork of Elk Creek near Newcastle, Colo., 1911–
East Fork of Elk Creek near Newcastle, Colo., 1911–

Colorado River—Continued.
Grand River—Continued.
West Divide Creek (head of Divide Creek) at Hostutler's ranch, near Raven, Colo., 1909.
West Divide Creek at Beard's ranch, near Raven, Colo., 1910–11.
West Divide Creek at Raven, Colo., 1909–1911.
West Mamm Creek near Rifle, Colo., 1909–1910.
Taylor River (head of Gunnison River) near Almont, Colo., 1905.
Taylor River at Almont, Colo., 1910–
Gunnison River near Gunnison, Colo., 1910–
Gunnison River near Iola, Colo., 1900–1903.
Gunnison River near Cimarron, Colo., 1903–1905.
Gunnison River at River Portal, Colo., 1905–1911.
Gunnison River near Cory, Colo., 1903–1905.
Gunnison River at Roubideau, Colo., 1897.
Gunnison River at Whitewater, Colo., 1897; 1901–1906.
Gunnison River near Grand Junction, Colo., 1894–1895; 1897–1899.
East River at Almont, Colo., 1905; 1910–
Cement Creek near Crested Butte, Colo., 1910–1913.
Tomichi Creek near Gunnison, Colo., 1910.
Quartz Creek near Pitkin, Colo., 1910–1913.
Cimarron Creek at Cimarron, Colo., 1903–1905.
North Fork of Gunnison River near Hotchkiss, Colo., 1903–1906.
Sapinero Creek at Sapinero, Colo., 1911–
Uncompahgre River near Colona, Colo., 1903–1906.
Uncompahgre River at Ouray, Colo., 1908; 1911–
Uncompahgre River below Ouray, Colo., 1913–
Uncompahgre River near Fort Crawford, Colo., 1910–11.
Uncompahgre River at Fort Crawford, Colo., 1895–1899; 1908–1910.
Uncompahgre River at Montrose, Colo., 1900; 1903–
Uncompahgre River near Delta, Colo., 1903–
Canon Creek at Ouray, Colo., 1911–
Dolores River at Dolores, Colo., 1895–1903; 1910–
San Miguel River near Fall Creek, Colo., 1895–1899; 1910.
San Miguel River at Placerville, Colo., 1910–
Fremont River near Thurber, Utah, 1909–1912.
Muddy Creek near Emery, Utah, 1909–
Muddy Creek (lower station) near Emery, Utah, 1911–
Ivie Creek near Emery, Utah, 1911–12.
Escalante Creek (head of Escalante River) near Escalante, Utah, 1909–1913.
San Juan River at Pagosa Springs, Colo., 1911–
San Juan River at Arboles, Colo., 1895–1899; 1910–
San Juan River at Turley, N. Mex., 1907–8.
San Juan River at Blanco, N. Mex., 1908–1910.
San Juan River near Bloomfield, N. Mex., 1909–1912.
San Juan River at Farmington, N. Mex., 1904–1906; 1912–
San Juan River near Shiprock, N. Mex., 1911–1913.
Navajo River at Chromo, Colo., 1911–12.
Navajo River at Edith, Colo., 1912–
Piedra River at Piedra, Colo., 1911–1912.
Piedra River at Arboles, Colo., 1895–1899; 1910–

Colorado River—Continued.
San Juan River—Continued.
Los Pinos River at Ignacio, Colo., 1899–1903; 1910–
Animas River at Silverton, Colo., 1903.
Animas River at Tacoma, Colo., 1908–1909; 1911.
Animas River at Durango, Colo., 1895–1905; 1910–
Animas River at Aztec, N. Mex., 1904; 1907–
Animas River at Farmington, N. Mex., 1912–
Animas River near Farmington, N. Mex., 1904–5.
Hermosa Creek near Hermosa, Colo., 1911–
Florida River near Durango, Colo., 1899; 1901–1903; 1910–
La Plata River at Hesperus, Colo., 1904–1906; 1910.
La Plata River at La Plata, N. Mex., 1905–
Mancos River at Mancos, Colo., 1898–1901.
West Mancos River near Mancos, Colo., 1910–11.
Little Colorado River at St. Johns, Ariz., 1906–1909.
Little Colorado River at Woodruff, Ariz., 1905–1908.
Little Colorado River at Holbrook, Ariz., 1905–1909.
Silver Creek at Snowflake, Ariz., 1906–1908.
Silver Creek at Canyon Station, Ariz., 1906.
Woodruff Ditch at Woodruff, Ariz., 1906.
Chevelon Fork near Winslow, Ariz., 1906–1908.
Clear Creek near Winslow, Ariz., 1906–1909.
Virgin River at Virgin, Utah, 1909–
Santa Clara River near Central, Utah, 1909–
Santa Clara River near St. George, Utah, 1909–
Muddy River near Moapa, Nev., 1904–1906; 1909–10; 1913–
Muddy River near St. Thomas, Nev., 1913–
Zion Creek near Springdale, Utah, 1913–
Bill Williams River near Swansea, Ariz., 1910–
Gila River near Cliff, N. Mex., 1904–1907.
Gila River near Silver City, N. Mex., 1912–
Gila River near Redrock, N. Mex., 1908–
Gila River at Guthrie, Ariz., 1910–
Gila River at San Carlos, Ariz., 1899–1905; 1910–11.
Gila River near Kelvin, Ariz., 1911–
Gila River near Buttes, Ariz., 1889–90; 1895–1899.
Gila River at Dome (Gila City), Ariz., 1903–1906.
Gila River at Sentinel, Ariz., 1912–
Gila River at mouth near Yuma, Ariz., 1903.
San Francisco River at Alma, N. Mex., 1904–1907; 1909–
San Francisco River at dam above Clifton, Ariz., 1911–
San Francisco River at Clifton, Ariz., 1910–
Whitewater Creek near Mogollon, N. Mex., 1909–
San Carlos River at San Carlos, Ariz., 1910–11.
San Pedro River near Lewis Springs, Ariz., 1910–11.
San Pedro River at Charleston, Ariz., 1904–1906.
San Pedro River near Fairbank, Ariz., 1911–12.
San Pedro River at Fairbank, Ariz., 1912–
San Pedro River near Dudleyville, Ariz., 1890.
Queens Creek at Whitlows, Ariz., 1896.
Santa Cruz River near Nogales, Ariz., 1907; 1909–
Santa Cruz River and ditches at Tucson, Ariz., 1905–
Rillito Creek near Tucson, Ariz., 1911–

Colorado River—Continued.
Gila River—Continued.
Salt River at Roosevelt, Ariz., 1901–1907; 1912.
Salt River below mouth of Cherry Creek near Roosevelt, Ariz., 1906.
Salt River 50 miles above Phoenix, Ariz., 1890.
Salt River at Arizona Dam, Ariz., 1888–1891.
Salt River at McDowell, Ariz., 1897–1910.
Black River near White River, Ariz., 1912–
Black River near Fort Apache, Ariz., 1912–
North Fork of White River (head of White River) near Fort Apache, Ariz., 1912–
East Fork of White River near Fort Apache, Ariz., 1912–
Tonto Creek at Roosevelt, Ariz., 1901–1904.
Verde River near Camp Verde, Ariz., 1911–
Verde River at Camp Verde, Ariz., 1912–
Verde River at McDowell, Ariz., 1889– (Records broken.)
Beaver Creek at Camp Verde, Ariz., 1912–
Agua Fria River near Glendale, Ariz., 1910–
Hassayampa River at Walnut Grove, Ariz., 1912–
Hassayampa River at Wickenburg, Ariz., 1910–1912.
White River near Douglas, Ariz., 1911–[1]

CANAL STATIONS IN COLORADO RIVER BASIN.

Imperial canal (main) near Calexico, Cal., 1904–5.
Boundary canal near Calexico, Cal., 1905.
Wisteria canal near Calexico, Cal., 1905.
Imperial canal 10 miles below Yuma, Ariz., 1903–1905.
Holt canal at Calexico, Cal., 1905–
Hemlock canal at Calexico, Cal., 1904–5.
Alamo channel near Calexico, Cal., 1904–
Alamitos canal near Calexico, Cal., 1904–5.
Vernal Milling & Lighting Co.'s canal at Vernal, Utah, 1913–

REPORTS ON WATER RESOURCES OF COLORADO RIVER BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

2. Irrigation near Phoenix, Ariz., by A. P. Davis. 1897. 98 pp., 31 pls. 15c.

Describes physiographic features, temperature, rainfall, stream-flow, soils, and projected irrigation works in Gila River Basin; discusses briefly possible use of underground water for irrigation and gives data concerning wells in Pinal and Maricopa counties. Chiefly of historic interest, as indicated by the date of publication.

33. Storage of water on Gila River, Arizona, by J. B. Lippincott. 1900. 98 pp., 33 pls. 15c.

Describes conditions existing in 1898–99, available water supply, silt, and reservoir sites (Buttes, Riverside, San Carlos, and Queen Creek); contains section on cement, and treats of irrigable land, distribution canals, and organization of irrigation. Interest chiefly historic.

[1] Flows into the Gulf of California in Mexico.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes various types of canals for irrigation.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II, (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" give information concerning temperature, quality of water, purposes of boring, etc. See also 149.

*73. Water storage on Salt River, Arizona, by A. P. Davis. 1902. 54 pp., 25 pls. 20c.

Discusses Verde and Salt River basins and McDowell and Salt River reservoirs.

74. Water resources of the State of Colorado, by A. L. Fellows. 1902. 151 pp., 14 pls. 25c.

Discusses drainage and irrigation; gives records of stream flow.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Investigations in Arizona, by A. P. Davis. Describes the proposed storage reservoir on Salt River at the mouth of Tonto Creek.

Salt River Valley Water Users' Association, by B. A. Fowler. Contains Judge Kibbey's address presenting a plan for the organization of the owners of lands to be irrigated.

Topographic work in the Grand Canyon of the Gunnison, by I. W. McConnell. Discusses the proposed diversion of water from Gunnison River into Uncompahgre Valley.

Colorado River, by J. R. Lippincott.

Colorado River reclamation projects, by E. T. Perkins. Describes the site of the Yuma dam and summarizes the advantages of the Yuma site.

104. The underground waters of Gila Valley, Arizona, by W. T. Lee. 1904. 71 pp., 5 pls. 10c.

Presents information concerning the topographic features and surficial geology of the area between The Buttes, 12 miles east of Florence and the junction of Gila and Salt rivers; treats of the source, amount, quality, and methods of securing the underflow.

136. Underground waters of Salt River valley, Arizona, by W. T. Lee. 1905. 196 pp., 23 pls. 25c.

Describes the physiography and geology of the Mesa and Phoenix region, gives many well records, and discusses the amount and chemical character of the underground waters, duty of water, and cost of pumping.

147. Destructive floods in United States in 1904, by E. C. Murphy and others. 15c. Contains:

La Plata River flood, Colorado, from report of Theo Tobish. Describes floods on the headwaters of the Big Sandy (tributary to the Colorado through Bill Williams River), on Sacramento Wash, and on La Plata River (tributary to the Colorado through San Juan River).

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States location, depth, diameter, yield, height of water, and other valuable information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Contains accounts of floods on Colorado, Green, Grand, Gunnison, San Juan, Little Colorado, Gila, San Francisco, Verde, San Pedro, and Salt rivers, and of the flow of the Colorado into Salton Sink; gives index to literature on floods on American streams.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Colorado, Green, Grand, Gunnison, Animas, Little Colorado, Gila, San Francisco, Salt, and Verde rivers.

*320. Geology and water resources of the Sulphur Spring Valley, Arizona, by O. E. Meinzer and F. C. Kelton, with a section on agriculture, by R. H. Forbes. 45c.

Describes the physiography and drainage of the region, geologic formations, and geologic history; discusses the seasonal and geographic distribution of rainfall, the occurrence and level of ground waters, the flowing and nonflowing wells, the quality of ground waters, the effect of alkali on plant life and on waters for irrigation, the relation of zones of vegetation to water supply and geographic controls, and the plants used for pumping water; treats also of the early history of agriculture and agricutural methods.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

Ninth Annual Report of the United States Geological Survey, 1887–88, J. W. Powell, Director. 1889. xiii, 717 pp., 88 pls. $2. Contains:

*On the geology and physiography of a portion of northwestern Colorado and adjacent parts of Utah and Wyoming, by C. A. White, pp. 677–712, Pl. LXXXVIII. Describes the canyons of Green, Yampa, Snake, and White rivers.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation. pp. xiv, 395, 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation, and a report on artesian irrigation on the Great Plains, including a discussion of the general considerations affecting artesian water supply, the economic limit to the utilization of artesian water for irrigation, irrigation by artesian wells in various countries, and the geologic conditions and statistics of artesian wells on the Great Plains.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II, Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

*The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, pp. x, 756, 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, Pls. XLVII–CII. Describes the Agua Fria dam, Arizona, and reservoir projects on Rio Verde, Salt River, Queen Creek, Hassayampa River, and Little Colorado River, Arizona, and in the Tonto basin; gives tables of reservoir capacities and areas.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, pp. xix, 498, 159 plates, 8 maps in separate case. $2.80. Contains:

*White River Plateau timber land reserve, by G. B. Sudworth, pp. 117–179, Pls. XLVIII–LVIII; Battlement Mesa forest reserve, by G. B. Sudworth, pp. 181–243, Pls. LIX–LXXV. Describes briefly the streams and lakes in the reserves.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming; and detailed record of well near Phoenix, Maricopa County, Ariz. The well of which a detailed section is given was selected because it affords valuable stratigraphic information.

*350. Geology of the Rangely oil district, Rio Blanco County, Colorado, with a section on the water supply of the Raven-Park district, by H. S. Gale, 1908. 60 pp., 4 pls. 20c.

Discusses White River and its tributaries as sources of water supply and the possibility of obtaining artesian flows; treats of the quality of the water of White River and gives analyses.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geoolgic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

111. Globe, Arizona.

Describes the physiographic divisions of Arizona and the topography, climate, and vegetation of the Globe quadrangle; discusses general geology and geologic history and structure, and, under "Economic geology," gives a brief account of the water resources.

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[1] Index maps showing areas in the Colorado River basin covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

120. Silverton, Colorado.

Describes an area in the San Juan Mountains including a portion of the Continental Divide, and sending streams through Animas River to the San Juan, through Uncompahgre to the Gunnison and the Colorado, and through small creeks to the Rio Grande. Folio describes topography and general geology of the region, the petrography and the areal geology, and includes in the discussion of the economic geology a brief study of the ground waters.

129. Clifton, Arizona.

Describes the relief and drainage of an area in eastern Graham County, the stratigraphic and structural geology, the streams and springs of the area; gives analyses of spring water from San Francisco River.

130. Rico, Colorado.

Describes the Rico Mountains and Dolores River valley, and the stratigraphic, structural, and historical geology of the Rico quadrangle, and, under "Economic geology," includes a brief paragraph on water resources.

153. Ouray, Colorado.

Describes the relief of the Ouray quadrangle, in southwestern Colorado, whose streams belong to the Gunnison River system and are thus tributary through Colorado River to the Gulf of California; discusses the stratigraphic, structural, and historical geology; and, under "Economic geology," describes the river waters used for irrigation, the underground waters, and the thermal springs; gives analyses of water from Hot Spring at Ouray.

171. Engineer Mountain, Colorado.

Describes the topography and geology of the Engineer Mountain quadrangle, in southwestern Colorado, about 60 miles east of the Utah boundary and 34 miles north of New Mexico; discusses the drainage, which passes to the Gulf of California through Colorado River; under "Economy geology" gives a brief paragraph on the water resources.

MISCELLANEOUS REPORTS.

Other Federal bureaus, State and other organizations have from time to time published reports relating to water resources of various sections of the country. Notable among those pertaining to the Colorado River basin are the reports of the State engineers of Colorado, Nevada, New Mexico, and Wyoming, and the annual reports of the United States Reclamation Service. The following reports deserve special mention:

Canyons of the Colorado, by J. W. Powell. 1895. A popular, revised, and enlarged edition of his original journal of exploration which appeared as part of a report entitled "Exploration of the Colorado River of the West and its tributaries, explored in 1869, 1870, 1871, and 1872 under the direction of the Secretary of the Smithsonian Institution," published by the Smithsonian Institution in 1875.

A canyon voyage; the narrative of the second Powell expedition down the Green-Colorado River from Wyoming and the explorations on land in the year 1871–72, by Frederick S. Dellenbaugh, artist and assistant topographer of the expedition. 1908.

Preliminary examination of reservoir sites in Wyoming and Colorado; letter from the Secretary of War transmitting a letter from the Chief of Engineers, together with a report of Captain Chittenden. 55th Cong., 2d sess., House Doc. 141.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bureau of Industry, Agriculture, and Irrigation, Bull. 8, 1913.

Report on irrigation investigations in Utah under the direction of Elwood Mead: U. S. Dept. Agr., Office of Experiment Stations, Bull. 124, 1903.

Irrigation in Utah. Utah Irrigation Commission, 1894.

PART X. THE GREAT BASIN.

PRINCIPAL DIVISIONS.

The Great Basin is made up of a number of minor basins whose streams do not discharge into the ocean. The largest of these minor basins are the depressions that hold Great Salt Lake, Sevier Lake, Humboldt Sink, Truckee, Walker, Carson, and Owens rivers, and Honey, Mono, Malheur, Harney, Warner, Abert, Summer, and Silver lakes. The streams of this section drain wholly or in part the States of California, Idaho, Nevada, Oregon, and Utah.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 129.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinuance.

GREAT SALT LAKE BASIN.

Great Salt Lake at Saltair, Utah, 1904.
Great Salt Lake at Garfield Beach gage, Utah, 1875–1899.
Bear River near Evanston, Wyo., 1913–
Bear River at Dingle, Idaho, 1903–
Bear (Mud) Lake inlet canal near Dingle, Idaho, 1911–
Bear River at Soda Springs, Idaho, 1896.
Bear River at Alexander, Idaho, 1911–
Bear River near Preston, Idaho, 1889–
Bear River near Collinston, Utah, 1889–
West Side canal near Collinston, Utah, 1913–
Hammond ditch near Collinston, Utah, 1913–
Bear Lake at Fishhaven, Idaho, 1904–1906.
Georgetown Creek near Georgetown, Idaho, 1911–
Soda Creek near Soda Springs, Idaho, 1913–
Cub Creek near Franklin, Idaho, 1900–1901.
Logan River near Logan, Utah, 1896–
Logan, Hyde Park, and Smithfield canal, near Logan, Utah, 1904–1907; 1909–1910; 1912–
Logan Northern canal near Logan, Utah, 1913–
Blacksmith Fork near Hyrum, Utah, 1900–1902; 1904–1910.
Blacksmith Fork power plant race near Hyrum, Utah, 1904–1910.
Little Malad River near Malad, Idaho, 1911–
Box Elder Creek at Brigham, Utah, 1909–1912.
Weber River near Oakley, Utah, 1904–
Weber River at Devils Slide (Croydon), Utah, 1905–
Weber River near Uinta, Utah, 1889–1903.

Great Salt Lake—Continued.
Weber River near Plain City, Utah, 1903–
Chalk Creek at Coalville, Utah, 1904–5.
Lost Creek near Croydon, Utah, 1905.
Ogden River at Ogden, Utah, 1895–1899.
Ogden River near Ogden, Utah, 1904–
Jordan River near Lehi, Utah, 1904; 1913–
Utah Lake near Spanish Fork, Utah, 1895–6.
Utah Lake near Outlet, Utah, 1896–1900.
Santaquin (Summit) Creek near Santaquin, Utah, 1905; 1910–
Peeteetneet Creek near Payson, Utah, 1908–
Spanish Fork at Thistle, Utah, 1908–
Spanish Fork near Spanish Fork, Utah, 1900–1901; 1903–
United States Reclamation Service power canal near Spanish Fork, Utah, 1909–
Spanish Fork near Mapleton, Utah, 1900–1901.
Spanish Fork at Lake Shore, Utah, 1903–1907; 1909–
Diamond Fork near Thistle, Utah, 1908–1910.
Hobble Creek near Springville, Utah, 1904–
Maple Creek near Springville, Utah, 1910–1913.
Provo River at Forks, Utah, 1911–
Provo River above Telluride Power Co.'s dam near Provo, Utah, 1905–1911.
Provo River at mouth of canyon near Provo, Utah, 1889–1906.
Provo River at Denver & Rio Grande Railroad bridge near Provo, Utah, 1905.
Provo River at San Pedro, Los Angeles & Salt Lake Railroad bridge near Provo, Utah, 1903–4.
South Fork of Provo River near Forks, Utah, 1911–
American Fork near American Fork, Utah, 1900–1901; 1903–1905; 1912–
South Fork of American Fork, 1912–
Little Cottonwood Creek near Salt Lake City, Utah, 1898–
Big Cottonwood Creek near Salt Lake City, Utah, 1898–
Mill Creek near Salt Lake City, Utah, 1898–
Parleys Creek near Salt Lake City, Utah, 1898–
Emigration Creek near Salt Lake City, Utah, 1898–
City Creek near Salt Lake City, Utah, 1898–

SEVIER LAKE BASIN.

Sevier River near Hatch, Utah, 1911–
Sevier River near Circleville, Utah, 1912–
Sevier River near Junction, Utah, 1911–
Sevier River at Piute Reservoir near Junction, Utah, 1911–
Sevier River below Piute Dam, near Marysvale, Utah, 1906–
Sevier River at Marysvale, Utah, 1912–
Sevier River at Sevier, Utah, 1911–
Sevier River at Joseph, Utah, 1889.
Sevier River near Vermilion, Utah, 1912.
Sevier River near Gunnison, Utah, 1900–
Sevier River near Juab, Utah, 1911–
Sevier River at Leamington, Utah, 1889–1893; 1912–
Sevier River near Delta, Utah, 1912.

Sevier River at Oasis, Utah, 1912–
Assay Creek near Hatch, Utah, 1912–
Mammoth Creek near Hatch, Utah, 1912–
Otter Creek near Coyote, Utah, 1913.
East Fork of Sevier River, near Kingston, Utah, 1912–
East Fork of Sevier River, at Junction, Utah, 1913.
Clear Creek at Sevier, Utah, 1912–
Salina Creek near Salina, Utah, 1900–1901.
San Pitch Creek near Gunnison, Utah, 1900–1905; 1912–
Manti Creek near Manti, Utah, 1900.
Beaver River near Beaver, Utah, 1906.
Beaver River at Minersville, Utah, 1909–1913.
Beaver River at Rocky Ford dam, near Minersville, Utah, 1913–
South Creek near Beaver, Utah, 1906.
North Fork of North Creek (head of North Creek) near Beaver, Utah, 1906.
South Fork of North Creek near Beaver, Utah, 1906.
Indian Creek near Beaver, Utah, 1906.

Canals in Sevier Valley:
Sevier Valley canal at Joseph, Utah, 1912–
Sevier Valley canal near Elsinore, Utah, 1913–
State canal near Richfield, Utah, 1912.
Sevier Valley canal near Vermilion, Utah, 1913.
Sevier Valley canal near Aurora, Utah, 1913.
Canal A at spillway near Delta, Utah, 1912–
Canal B at intake near Delta, Utah, 1912–13.
Canal C at head gate near Delta, Utah, 1912–13.
Lymans ditch near Delta, Utah, 1912–13.
Abraham canal near Delta, Utah, 1913–
Melville main canal near Delta, Utah, 1912–
Melville west side canal near Delta, Utah, 1912–13.
Deseret canal near Delta, Utah, 1913–
Deseret high-line canal near Delta, Utah, 1913–
Minersville canal at Minersville, Utah, 1906.

MINOR BASINS IN NEVADA.

Snake Creek near Garrison, Utah, 1913–
Thousand Springs Creek near Tecoma, Nev., 1910–
Steptoe Creek near Ely, Nev., 1913.
Baker Creek near Baker, Nev., 1913–
White River near Preston, Nev., 1913–
Currant Creek above reservoir, near Currant, Nev., 1913–
Currant Creek at Cozier's ranch, near Currant, Nev., 1913–
Currant Creek at ranger station near Currant, Nev., 1913.

SALTON SINK BASIN.

Salton Sea near Salton, Cal., 1904–
Alamo River near Brawley, Cal., 1909–1912.
New River near Brawley, Cal., 1909–1911.

OWENS LAKE BASIN.

Owens River near Round Valley, Cal., 1903–
Owens River near Big Pine [Tinemaha], Cal., 1906–
Owens River near Citrus, Cal., 1903–1906.
Owens River near Lone Pine, Cal., 1909–

Owens Lake near Olancha, Cal., 1908–
Rock Creek near Round Valley, Cal., 1903–
Pine Creek near Round Valley, Cal., 1903–
Bishop Creek near Bishop, Cal., 1903–1911.
Baker Creek near Big Pine, Cal., 1908–1911.
Big Pine Creek near Big Pine, Cal., 1903–1911.
Tinemaha Creek near Big Pine (Tinemaha), Cal., 1906–1911.
Birch Creek near Big Pine (Tinemaha), Cal., 1905; 1906–1911.
Taboose Creek near Aberdeen, Cal., 1906–1911.
Goodale Creek near Aberdeen, Cal., 1906–1910.
Division Creek near Independence, Cal., 1906–1910.
Eightmile (Sawmill) Creek near Independence, Cal., 1906–1910.
Thebaut Creek near Independence, Cal., 1908–1911.
Oak Creek near Independence, Cal., 1905–1911.
Independence Creek near Independence, Cal., 1905–1911.
Shepherd Creek near Thebe, Cal., 1906–1910.
Bairs Creek near Thebe, Cal., 1906–1911.
George Creek near Thebe, Cal., 1906–1911.
Little Pine Creek near Independence, Cal., 1905–1911.
Lone Pine Creek near Lone Pine, Cal., 1906–1911.
Tuttle Creek near Lone Pine, Cal., 1906–11.
Cottonwood Creek near Olancha, Cal., 1906–1911.
Ash Creek near Olancha, Cal., 1907–1911.
Canals in Owens River valley:
Bishop Creek canal near Bishop, Cal., 1903–1905.
Collins (George) canal near Bishop, Cal., 1903–1906.
Collins (A. O.) canal near Bishop, Cal., 1903–1906.
Dell canal near Bishop, Cal., 1903–1906.
East Side canal near Citrus, Cal., 1903–1906.
Farmers canal near Bishop, Cal., 1903–1905.
Hillside (North) canal near Bishop, Cal., 1903–1905.
Hillside (South) canal near Bishop, Cal., 1903–1905.
McNally canal near Bishop, Cal., 1903–1905.
Owens River and Big Pine canal near Bishop, Cal., 1903–1905.
Owens River canal near Bishop, Cal., 1903–1905.
Powers canal near Bishop, Cal., 1903–1905.
Rawson canal near Bishop, Cal., 1903–1905.
Sanger canal near Alvord, Cal., 1903–1905.
Stevens canal near Citrus, Cal., 1903–1905.

ANTELOPE VALLEY BASIN.

Littlerock Creek near Palmdale, Cal., 1896–1898.

MOHAVE RIVER BASIN.

Mohave River near Victorville, Cal., 1899–1906.

MONO LAKE BASIN.

Mono Lake near Mono Lake, Cal., 1912–
Rush Creek near Mono Lake, Cal., 1910–
Leevining Creek near Mono Lake, Cal., 1910–

WALKER LAKE BASIN.

East Walker River (head of Walker River), Bridgeport, Cal., 1911–
East Walker River near Yerington, Nev., 1902–1908.
East Walker River near Mason, Nev., 1910–1912.
Walker River near Nordyke, Nev., 1895.
Walker River at Mason, Nev., 1910–1912.
Walker River near Wabuska, Nev., 1902–1908.
Robinson Creek near Bridgeport, Cal., 1910–
Buckeye Creek near Bridgeport, Cal., 1910–
Swagar Creek near Bridgeport, Cal., 1911–
West Walker River near Coleville, Cal., 1902–1908; 1909–10.
West Walker River near Wellington, Nev., 1910.
West Walker River at Smith, Nev., 1910.
East Fork of West Walker River near Bridgeport, Cal., 1910.

HONEY LAKE BASIN.

Susan River near Susanville, Cal., 1900–1905.
Willow Creek at Merrillville, Cal., 1904–5.
Willow Creek near Standish, Cal., 1900–1901; 1905.

CARSON-HUMBOLDT SINK.

Carson River basin:
East Fork of Carson River (head of Carson River) at Silver King Valley, near Markleeville, Cal., 1910–1913.
East Fork of Carson River near Markleeville, Cal., 1910–
East Fork of Carson River at Rodenbah's ranch, near Gardnerville, Nev., 1900–1907.
East Fork of Carson River at Horseshoe Bend, near Gardnerville, Nev., 1900–1910.
Carson River and Brunswick Mill power canal near Empire, Nev., 1900–1911.
Carson River near Empire, Nev., 1900–
Carson River near Fort Churchill, Nev., 1911–
Carson River near Hazen, Nev., 1908–1910.
Silver Creek near Markleeville, Cal., 1910–1913.
Markleeville Creek above Markleeville, Cal., 1911–
Markleeville Creek at Markleeville, Cal., 1910–
Pleasant Valley Creek near Markleeville, Cal., 1910–11.
West Fork of Carson River at Woodfords, Cal., 1900–
Humboldt River basin:
Humboldt River near Elko, Nev., 1895–1902.
Humboldt River at Palisade, Nev., 1902–1906; 1911–
Humboldt River at Battle Mountain, Nev., 1896–7.
Humboldt River near Golconda, Nev., 1894–1909; 1910–
Humboldt River near Oreana, Nev., 1896–1909; 1910–
Humboldt River near Lovelocks, Nev., 1912–
Bishop Creek near Wells, Nev., 1910.
Marys River near Carlin, Nev., 1913–
Marys River near Buena Vista, Nev., 1913–
Marys River near Deeth, Nev., 1902–3; 1912–
Hanks Creek near Buena Vista, Nev., 1913–
North Fork of Humboldt River near Peko, Nev., 1898–1900.

Humboldt River basin—Continued.
Humboldt River tributaries—Continued.
North Fork of Humboldt River near Halleck, Nev., 1902–1913.
North Fork of Humboldt River near Elko, Nev., 1913–
Starr Creek near Deeth, Nev., 1913–
Lamoille Creek near Halleck, Nev., 1913–
South Fork of Humboldt River near Elko, Nev., 1896–1909; 1910–
Maggie Creek near Carlin, Nev., 1913–
Jacks Creek near Tuscarora, Nev., 1913–
Pine Creek at Palisade, Nev., 1902–1904; 1912–
Reese River near Austin, Nev., 1913–
Big Creek near Austin, Nev., 1913–
Birch Creek near Austin, Nev., 1913–
Rock Creek near Battle Mountain, Nev., 1896.

PYRAMID AND WINNEMUCCA LAKE BASINS.

Lake Tahoe at Tahoe, Cal., 1900–
Truckee River at Tahoe, Cal., 1895, 1900–
Truckee River near Boca, Cal., 1890.
Truckee River at Iceland, Cal., 1912–
Truckee River at Nevada-California State line, 1899–1912.
Truckee River at Laughton, Nev., 1890.
Truckee River at Reno, Nev., 1906–
Truckee River near Essex, Nev., 1889.
Truckee River at Vista, Nev., 1899–1908.
Truckee River at Clark, Nev., 1907–
Truckee River at Derby Dam, Nev., 1907–1910.
Truckee River near Wadsworth, Nev., 1902–1905.
Lake Winnemucca inlet near Wadsworth, Nev., 1902–1905.
Donner Creek at Donner Lake near Truckee, Cal., 1909–10.
Donner Creek near Truckee, Cal., 1902–
Prosser Creek near Hobart Mills (Truckee), Cal., 1903–4; 1907–1912.
Prosser Creek near Boca, Cal., 1889–90; 1902–3.
South Fork of Prosser Creek near Truckee, Cal., 1909–10.
Little Truckee River near Truckee, Cal., 1909–10.
Little Truckee River near Boca, Cal., 1890.
Little Truckee River at Boca, Cal., 1911–
Little Truckee River at Pine Station and Starr, Cal., 1903–1910.
Webber Creek near Truckee, Cal., 1909–10.
Independence Creek below Independence Lake, Cal., 1902–1907.
Independence Creek near Truckee, Cal., 1909–10.
Steamboat Creek at Steamboat Springs, Nev., 1900–1901.

QUINN RIVER BASIN.

Kings River near Amos, Nev., 1913–

SURPRISE VALLEY DRAINAGE BASIN.

Bidwell Creek near Fort Bidwell, Cal., 1912.

WARNER LAKE BASIN.

Pelican Lake near Adel, Oreg., 1913–
Crump Lake near Adel, Oreg., 1910–
Hart Lake near Plush, Oreg., 1910–
Flagstaff Lake near Plush, Oreg., 1910–
Bluejoint Lake, near Plush, Oreg., 1911–

Twentymile Creek near Warner Lake, Oreg., 1910–
Fifteenmile Creek above Twelvemile Creek near Fort Bidwell, Cal., 1913–
Fifteenmile Creek below Rock Creek near Fort Bidwell, Cal., 1913–
Twelvemile Creek near Fort Bidwell, Cal., 1912–13.
Cowhead Lake near Fort Bidwell, Cal., 1911–1913.
Rock Creek near Fort Bidwell, Cal., 1913–
Deep Creek near Fort Bidwell, Cal., 1913–
Deep Creek at Big Valley near Lakeview, Oreg., 1911–
Deep Creek at Adel, Oreg., 1909–
Dismal Creek near Fort Bidwell, Cal., 1913–
Camas Creek near Plush, Oreg., 1911–12.
Camas Creek below Blue Creek near Lakeview, Oreg., 1912–
Mud Creek near Plush, Oreg., 1911–12.
Honey Creek at Chalstrand's ranch near Plush, Oreg., 1910–11.
Honey Creek near Plush, Oreg., 1909–
Twelvemile Creek near Plush, Oreg., 1911.
Snyder Creek near Plush, Oreg., 1911.

ABERT LAKE BASIN.

Chewaucan River at dam site near Paisley, Oreg., 1912–13.
Chewaucan River above Conn's ditch near Paisley, Oreg., 1912.
Chewaucan River at Paisley, Oreg., 1905–1907; 1909–1912.
Crooked Creek near Valley Falls, Oreg., 1912–13.

SUMMER LAKE BASIN.

Ana River near Summer Lake, Oreg., 1905; 1909–10.

SILVER LAKE BASIN.

Silver Creek near Silver Lake, Oreg., 1904–1907; 1909–
Bridge Creek near Silver Lake, Oreg., 1905–6; 1911–12.
Bear (Buck) Creek near Silver Lake, Oreg., 1905–6; 1909–1911.

MALHEUR AND HARNEY LAKES BASIN.

Malheur Lake at Narrows, Oreg., 1911–
Silvies River near Silvies, Oreg., 1903–1905; 1909–1912.
Silvies River near Burns, Oreg., 1903–1906; 1909–1913.
Donner und Blitzen River near Diamond, Oreg., 1911–
Mud Creek near Diamond, Oreg., 1911–
Bridge Creek near Diamond, Oreg., 1911–
Krumbo Creek near Diamond, Oreg., 1911.
Keiger Creek near Diamond, Oreg., 1909–
Cucamonga Creek near Diamond, Oreg., 1911–
McCoy Creek near Diamond, Oreg., 1909–
Riddle Creek near Smith, Oreg., 1911.
Silver Creek above Riley, Oreg., 1904–1906; 1909–1912.
Silver Creek below Riley, Oreg., 1912–13.

ALVORD LAKE BASIN.

Trout Creek near Denio, Oreg., 1911–12.
Little Cottonwood Creek near Denio, Oreg., 1911–12.

TUMTUM LAKE BASIN.

Van Horn Creek near Denio, Oreg., 1911
Home Creek near Narrows, Oreg., 1911.

REPORTS ON WATER RESOURCES OF THE GREAT BASIN.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*7. Seepage water of northern Utah, by Samuel Fortier. 1897. 50 pp., 3 pls.
Describes Cache Valley and its water supply and seepage waters in Ogden Valley.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls.
Describes the location and construction of various types of canals for irrigation.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp.

61. Preliminary list of deep borings in the United States, Part II, (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.
A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

*81. California hydrography, by J. B. Lippincott. 1903. 440 pp., 1 pl. 25c.
A collection of published records of stream flow "hitherto much scattered, some of them out of print and difficult to secure," brought together as a book of reference.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.
Flow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the Reclamation Service.]. Contains:
A brief report on "Hydrographic investigations in Nevada," by A. E. Chandler. Gives notes concerning fluctuations and average discharge at stations on Truckee, Humboldt, Carson, and Walker rivers.
A report on "Underground waters of southern California," by W. C. Mendenhall. Discusses the origin, distribution, and character of the artesian waters, the causes of fluctuations in the supply, and the need of moderation in use.

149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.
Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61: mentions also principal publications relating to deep borings.

*157. Underground water in the valleys of Utah Lake and Jordan River, Utah, by G. B. Richardson. 1906. 81 pp., 9 pls. 20c.
Discusses the source, distribution, recovery, and quality of waters; contains list of typical wells.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.
Gives estimates of flood flow and frequency of Bear River at Collinston, Utah, and Humboldt River at Golconda, Nev. (p. 85), also index to literature of floods on American streams.

*181. Geology and water resources of Owens Valley, Cal., by W. T. Lee. 1906. 28 pp., 6 pls. 15c.
Discusses artesian conditions, utilization of underground waters by pumping and power plants, and undrained lakes as registers of climate. See also Water-Supply Paper 294.

*199. Underground water in Sanpete and central Sevier valleys, Utah, by G. B. Richardson. 1907. 63 pp., 6 pls. 25c.

Describes topography and geology of the area, the sources, distribution, recovery, and quality of the ground waters; presents tabulated data concerning springs and wells.

*217. Water resources of Beaver Valley, Utah, by W. T. Lee. 1908. 57 pp., 4 pls. 10c.

Describes possible development of surface and underground waters, and quality of waters; contains field assays of well water, and sanitary and other exact analyses.

*220. Geology and water resources of a portion of south-central Oregon, by G. A. Waring. 1908. 86 pp., 10 pls. 20c.

Describes the rocks, streams, lakes and lake valleys, deep and shallow wells, climate, soils, vegetation, industries, and reclamation projects in Lake County; gives analyses of soils and waters.

*224. Some desert watering places in southeastern California and southwestern Nevada, by W. C. Mendenhall. 1909. 98 pp., 4 pls. 20c.

Describes physical features of the Colorado and Mohave deserts and the Death Valley region, mineral resources and industrial development, climate, rivers, springs, and camping places; gives hints on desert traveling; describes main routes of travel, and gives details concerning the springs.

*225. Ground waters of the Indio region, California, with a sketch of the Colorado Desert, by W. C. Mendenhall. 1909. 56 pp., 12 pls. 20c.

Describes the structural features and deposits of the Colorado Desert, rainfall and drainage, the origin, source, character, and development of underground waters; gives history of development of the Indio region, and discusses soils, crops, and cost of reclamation.

*231. Geology and water resources of the Harney Basin region, Oregon, by G. A. Waring. 1909. 93 pp., 5 pls. 25c.

Describes topography, climate, vegetation, settlements and industries, the rocks and their successive lakes, springs, and streams, and artesian conditions; discusses conservation of water supply, temperature of underground waters, and well-drilling methods; describes in detail Harney, Catlow, Alvord, Whitehorse basins, and Malheur River drainage area.

237. The quality of the surface waters of California, by Walton Van Winkle and F. M. Eaton. 1910. 142 pp., 1 pl. 20c.

Describes geography, climate, industrial development, and drainage, and gives results of mineral analyses of the river waters.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work and methods of analyses; discusses soap consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Carson, Truckee, and Owens rivers.

277. Ground water in Juab, Millard, and Iron counties, Utah, by O. E. Meinzer. 1911. 162 pp., 5 pls. 25c.

Describes the physiographic features, geologic formations, and history, the rainfall, soil, vegetation, streams, and industrial development; discusses the occurrence of ground water in the bedrock and in unconsolidated sediments, artesian conditions and springs, the quality of the ground waters, irrigation, construction of wells, and watering places on routes of travel; describes in detail Juab, Valley, Round, Little, Sage, Dog, and Fernow valleys, Tintic Valley and Tintic mining district, Pavant and Lower Beaver valleys, Old River Bed and Cherry Creek region, Drum and Swasey Wash region, Sevier Desert, Wah Wah Valley, Sevier Lake bottoms, White, Fish Springs, Snake, Parowan, and Rush Lake valleys and Escalante Desert; analyses.

*278. Water resources of Antelope Valley, Cal., by H. R. Johnson. 1911. 92 pp., 7 pls. 25c.

Describes topography, drainage, climate, physiography, and the water-bearing and nonwater-bearing rocks of areas in Kern, Los Angeles, and San Bernardino counties; discusses the influence of rainfall on the surface and underground waters, the artesian water and nonartesian water, bedrock springs, chemical character (analyses, alkali, dissolved solids, hygienic conditions), fallacies as to origin and quantities of artesian water and the present and future development of the underground supplies.

*294. An intensive study of the water resources of a part of Owens Valley, Cal., by C. H. Lee. 1912. 135 pp., 30 pls. 55c.

Describes topography, drainage, and structure of the valley, and discusses precipitation, stream flow, evaporation, percolation, and ground waters; bibliography.

*297. Gazetteer of surface waters of California, Pt. III: Pacific coast and Great Basin streams, by B. D. Wood. 1913. 244 pp. 20c.

Contains description of streams and lakes of the Great Basin in California.

*300. Water resources of California, Pt. III: Stream measurements in the Great Basin and Pacific coast river basins, by H. D. McGlashan and H. J. Dean. 1913. 956 pp., 4 pls. 55c.

Describes the general features of the Great Basin in California, the Great Basin lakes in California and Nevada and gives results of stream-flow investigations available up to September 30, 1912.

333. Ground water in Box Elder and Tooele counties, Utah, by Everett Carpenter. 1913. 90 pp., 2 pls. 10c.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Third Annual Report of the United States Geological Survey, 1881–82, J. W. Powell, Director. 1883. xviii, 564 pp., 67 pls. $2.35. Contains:

*Sketch of the geological history of Lake Lahontan, by I. C. Russell, pp. 189–235, Pls. XVIII–XXIII. Describes the physical features of the Great Basin.

*Fourth Annual Report of the United States Geological Survey, 1882–83, J. W. Powell, Director. 1884. xxxii, 473 pp., 85 pls. $1.65. Contains:

*A geological reconnaissance in southern Oregon, by I. C. Russell, pp. 431–464, Pls. LXXXIII–LXXXV. Describes the interior drainage of southern Oregon; discusses the area, extent, quality of waters, and recent changes in the existing lakes.

*Eighth Annual Report of the United States Geological Survey, 1886–87, J. W. Powell, Director. 1889. 2 parts. Part I, pp. i–xix, 1–474, i–xii, pls. i–liii. $1.50. Contains:

*The Quaternary history of Mono Valley, Calif., by I. C. Russell, pp. 261–394, Pls. XVI–XLIV. Describes the physiographic features and drainage of the Mono Lake basin, the sources of water supply of the present lake, including streams and springs, and discusses the chemical composition of the water and the fluctuations in lake level.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation. pp. xiv, 395, 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement to the Director of the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, pp. xviii, 576, 93 pls. $2.00. Contains:

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites in Carson River basin at Red Lake, Pleasant Valley, Mount Bullion, Indian Pool, Heenan Lake, Silver King Valley, Wolf Creek, Dumont's Meadow, all in Alpine County, along Rush Creek, in Hulls Meadow, on Little Truckee River, at Twin Valley on the North Fork of Prosser Creek, at Monument Peak, at Grass Lake, and at Hope Valley, in California, and on Truckee River, Nev.; for each reservoir site gives the location, height of dam, area inclosed by contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, Pls. CXLVII–CLXXXII. Describes Donner Lake, Independence Lake, and Webber Lake reservoirs, also Truckee canals in the Truckee River system, and Long Valley and Hope Valley reservoirs in the Carson River basin, Nev.

Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1892, by A. H. Thompson, pp. 451–478. Describes Bear Lake reservoir site (Utah-Idaho), Silver Lake, Twin Lakes, and Marys Lake sites, and sites on Sanpitch, Sevier, East Fork of Sevier, Otter Creek, Panquitch Lake, and at Blue Spring, Utah.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

*The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report of the United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. (Pts. II and III, 1898.) 5 parts in 6 vols. *Pt. IV, Hydrography, pp. x, 756, 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, Pls. XLVII–CII. Discusses proposed Rock Creek reservoir on Humboldt River, Nev.; gives tables of reservoir capacities and areas; describes proposed reservoir of Antelope Valley Water Co., California, and on Rock Creek Humboldt River, Nev.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest Reserves, pp. xix, 498, 159 pls., 8 maps in separate case. $2.80. Contains:

*The San Gabriel Forest Reserve, by J. B. Leiberg, pp. 411–428, Pls. CXLIII–CXLVI. The San Bernardino Forest Reserve, by J. B. Leiberg, pp. 429–454, Pls. CXLVII–CLIII. The San Jacinto Forest Reserve, by J. B. Leiberg, pp. 455–478, Pls. CLIV–CLIX. Describes general topographic features of forest reserves and drainage, part of which is by streams tributary to the Pacific, and part by streams that are lost in the sands of the Mohave and other deserts.

MONOGRAPHS.

Monographs are of quarto size. They are not distributed free, but may be obtained from the Geological Survey at the prices indicated. An asterisk (*) indicates that the Survey's stock of the paper is exhausted.

*I. Lake Bonneville, by G. K. Gilbert. 1890. xx, 438 pp., 51 pls., 1 map.

Contains in the introduction a description of the Great Basin; describes the present lakes and their oscillations, and gives analyses of the waters of Great Salt Lake and of fresh waters in the Salt Lake Basin.

*XI. Geological history of Lake Lahontan, a Quaternary lake of northwestern Nevada, by I. C. Russell. 1885. xiv, 288 pp., 46 pls. $1.75.

Contains descriptions of the present rivers and lakes; discusses the chemical deposits of the area and gives analyses showing the composition of the principal rivers and lakes of the Lahontan Basin.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

252. Preliminary report on the geology and water resources of central Oregon, by I. C. Russell. 1905. 138 pp., 24 pls. 15c.

Describes a portion of the extreme northern part of the Great Basin and a part of the drainage area of Deschutes River and its principal tributary, Crooked River; gives an account of the topography, drainage, rainfall, and temperature, winds, and forests; describes the volcanic and sedimentary rock formations, and discusses by counties the geology and topography, the surface and underground waters; treats of artesian conditions in the Deschutes Basin and makes suggestions concerning artesian well records.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to geologists; describes the general methods of work; gives tabulated records of wells in Utah.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in California, Idaho, Nevada, Oregon, and Utah; and detailed record of well at Salt Lake City, Utah. The well of which a detailed section is given was selected because it affords valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped. The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sell for 25 cents a copy, except that some folios which contain an unusually large amount

of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sell for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

39. Truckee folio, California.

Describes the general and economic geology of an area extending westward and northward from Truckee Lake, drained by streams a part of which flow through Yuba and American rivers to the Sacramento, and part through Lake Tahoe to the Great Basin; discusses the topography and geology, and under "Economic geology" the mineral springs which occur abundantly throughout the area.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the Great Basin are the reports of the reclamation board, the State engineer and surveyor, the State Conservation Commission of California, the State board of land commissions, and the State engineers of Idaho, Oregon, Utah, and Wyoming, the biennial reports of the Bureau of Industry, Agriculture, and Irrigation of Nevada, and the annual reports of the United States Reclamation Service.

The following reports deserve special mention:

Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912, with detailed statement of the Oregon system of water titles.

State and national water laws, by John H. Lewis, with a discussion by Messrs. Clarence T. Johnston and L. J. Le Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637–758, 1913.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bureau of Industry, Agriculture, and Irrigation Bull. 8, 1013.

Report on irrigation investigations in Utah, under the direction of Elwood Mead: U. S. Dept. Agr. Office Exper. Sta. Bull. 124, 1903.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the appropriation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

PART XI.—PACIFIC COAST BASINS IN CALIFORNIA.

PRINCIPAL STREAMS.

The rivers draining into the Pacific Ocean from California include Tia Juana, Sweetwater, San Diego, Bernardo, San Luis Rey, and Los Angeles rivers, draining areas to the south of San Francisco Bay; San Joaquin River, whose chief tributaries are Kern, Kings, Merced, Tuolumne and Stanislaus rivers; Sacramento River, whose principal tributaries are Pit, Feather, and American; and Russian, Eel, Mad, and Klamath rivers, which flow into the ocean north of San Francisco Bay. Except Klamath River, which receives the drainage from a small area in Oregon, and a few streams in Oregon that flow into Goose Lake, at the head of Pit River, all the streams in this division are entirely in California.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 146.)

GAGING STATIONS.

NOTE.—Dash following a date indicates that the station was being maintained June 30, 1913; period after date indicates discontinuance.

DRAINAGE BASINS SOUTH OF SAN FRANCISCO BAY.

Tia Juana River:
- Cottonwood Creek and Dulzura conduit near Jamul, Cal., 1905–
- Pine Valley Creek near Jamul, Cal., 1906–1908.

Sweetwater River near Descanso, Cal., 1905–

San Diego River at Lakeside, Cal., 1905–

San Diego River near Santee, Cal., 1912–
- Boulder Creek at Cuyamaca reservoir near Lakeside, Cal., 1912–
- Boulder Creek at mouth near Lakeside, Cal., 1912–
- San Diego flume at diverting dam near Lakeside, Cal., 1912–
- San Diego flume near Lakeside, Cal., 1907–

Santa Ysabel Creek (head of San Dieguito River) near Ramona, Cal., 1912–

Santa Ysabel Creek near Escondido, Cal., 1905–1912.

San Dieguito River at Bernardo, Cal., 1912–
- East San Pasqual ditch near Escondido, Cal., 1912.
- West San Pasqual ditch near Escondido, Cal., 1912.

San Luis Rey River at diversion flume, 1894–1899.

San Luis Rey River near Mesa Grande, Cal., 1911–

[1] For special reports on stream measurements in California, see Water-Supply Papers 298–300. (See p. 142.)

San Luis Rey River near Pala, Cal., 1903–1911.
San Luis Rey River at Pala, Cal., 1912.
San Luis Rey River at Bonsall, Cal., 1912–
San Luis Rey River near Oceanside, Cal., 1912–
Escondido Mutual Water Co.'s canal near Nellie, Cal., 1905–1912.
Rincon Indian Reservation ditch near Valley Center, Cal., 1912.
Pala Indian Reservation canal at Pala, Cal., 1912.
Temecula Creek (head of Santa Margarita River) near Temecula, Cal., 1905–6.
Santa Ana River and power canal near Mentone, Cal., 1896–
Highlands or North Fork canal at intake weir, San Bernardino County, Cal., 1896–1904.
Redlands or South Fork canal at Sand Box weir, San Bernardino County, Cal., 1896–1904.
Mill Creek in canyon near headworks of Crafton canal, Cal., 1896–1905.
Mill Creek at Forest Home, Cal., 1903–
Waterman Canyon Creek near San Bernardino, Cal., 1911–
Devil Canyon Creek near San Bernardino, Cal., 1911–
Lytle Creek at mouth of canyon, Cal., 1894–1901.
Lytle Creek near San Bernardino, Cal., 1904–
Temescal Creek near Rincon, Cal., 1899.
Coldwater Creek above dam, Riverside County, Cal., 1899.
San Antonio Creek near Upland, Cal., 1901–
San Gabriel River above Fish Fork, near Azusa, Cal., 1900–1901; 1910; 1912. (Low-water records.)
San Gabriel River and canals near Azusa, Cal., 1895–
Pacific Light & Power Co.'s canal near Azusa, Cal., 1896–
West branch of North Fork of San Gabriel River at weir, 1911.
North branch of North Fork of San Gabriel River at weir, 1911.
West Fork of San Gabriel River above North Fork, Cal., 1900.
Coldwater Creek at weir above mouth, 1900.
Fish Fork of San Gabriel River near Azusa, Cal., 1900–1901; 1910; 1912. (Low-water record.)
Iron Fork of San Gabriel River near Azusa, Cal., 1900–1901; 1910; 1912. (Low-water record.)
Los Angeles River at Los Angeles, Cal., 1896–1900.
Arroyo Seco near Pasadena, Cal., 1910–
Malibu Creek near Calabasas, Cal., 1903–1906.
Triunfo Creek near Calabasas, Cal., 1903–1906.
Santa Clara River at Fillmore, Cal., 1911–12.
Piru Creek near Piru, Cal., 1911–
Sespe Creek at Sespe, Cal., 1911–
Santa Paula Creek near Santa Paula, Cal., 1911–
Ventura River near Nordhoff, Cal., 1911–
Ventura River near Ventura, Cal., 1911–
San Roqui Creek, Santa Barbara County, Cal., 1890.
San Jose Creek, Santa Barbara County, Cal., 1890.
Loma Abajo River, Santa Barbara County, Cal., 1890.
Gato Creek at mouth, Santa Barbara County, Cal., 1890.
Santa Ynez River near Santa Barbara, Cal., 1903–1908; 1910–
Santa Ynez River near Lompoc, Cal., 1906–
Mono Creek at Mono dam site near Santa Barbara, Cal., 1902–1904.
Santa Maria River near Santa Maria, Cal., 1903–1905.

Salinas River near Salinas, Cal., 1900–1901.
Nacimiento Creek near Bryson, Cal., 1901.
San Antonio River near Jolon, Cal., 1900–1901.
San Lorenzo Creek near King City, Cal., 1900–1903; 1911–12.
Arroya Seco near Soledad, Cal., 1901–
Pajaro River at Watsonville, Cal., 1911–

SAN FRANCISCO BAY.

Minor streams.

Coyote River near Madrone, Cal., 1902–

San Joaquin River basin.

San Joaquin River near North Fork, Cal., 1910–
San Joaquin River near Friant, Cal., 1907–
San Joaquin River at Hamptonville, Cal., 1878–1884.
San Joaquin River at Herndon, Cal., 1891–1909.
San Joaquin River near Newman, Cal., 1912–
Tulare Lake in Kings County, Cal., 1906–
Kern River near Kernville, Cal., 1912–
Kern River at Kernville, Cal., 1905–
Kern River Power Co.'s canal at Kernville, Cal., 1910–
Kern River at Isabella, Cal., 1910–
Kern River at Rio Bravo ranch, Cal., 1878–1884.
Kern River near Bakersfield, Cal., 1893–
South Fork of Kern River near Onyx, Cal., 1911–
South Fork of Kern River at Isabella, Cal., 1910–
Erskine Creek near Isabella, Cal., 1911–
Caliente Creek at base of foothills, Kern County, 1878–1884.
Basin Creek near Havilah, Cal., 1911–
Tejon House Creek at Tejon ranch house, Cal., 1895–6.
San Emigdio Creek at San Emigdio ranch house, Cal., 1894–5.
Poso Creek at base of foothills, Kern County, Cal., 1878–1884.
White River at base of foothills, Tulare County, Cal., 1878–1884.
White River near Hot Springs, Cal., 1911–
Deer Creek at base of foothills, Tulare County, Cal., 1878–1884.
Deer Creek at Hot Springs, Cal., 1910–
Tyler Creek near Hot Springs, Cal., 1911–
Tule River at Portersville, Cal., 1878–1884.
Tule River near Portersville, Cal., 1901–
North Fork of Middle Fork of Tule River near Springville, Cal., 1909–
South Fork of Middle Fork of Tule River near Springville, Cal., 1909–
Bear Creek near Springville, Cal., 1911–
South Fork of Tule River near Success, Cal., 1910–
Kaweah River at Wachumna Hill, Cal., 1878–1884.
Kaweah River near Three Rivers, Cal., 1903–
North Fork of Kaweah River at Kaweah, Cal., 1910–
South Fork of Kaweah River near Three Rivers, Cal., 1911–

San Joaquin River tributaries—Continued.
Kings River at Suspension Bridge, Cal., 1895.
Kings River near Sanger, Cal., 1895–
Kings River at Slate Point, Cal., 1878–1884.
Kings River at Kingsburg, Cal., 1891–1904.
North Fork of Kings River:
Dinkey Creek near Ockenden, Cal., 1910–
Big Creek near Tollhouse, Cal., 1911–
Rush Creek near Ockenden, Cal., 1910–
Big Creek near Shaver, Cal., 1910–
Pitman Creek near Shaver, Cal., 1910–
North Fork of San Joaquin River near North Fork, Cal., 1910–11.
Crane Valley reservoir near North Fork, Cal., 1910–
South Fork Creek near North Fork, Cal., 1910–
South Fork ditch near North Fork, Cal., 1910.
Whisky Creek near North Fork, Cal., 1910–
Cascadel Creek near North Fork, Cal., 1910–
Fresno River at base of foothills, Madera County, Cal., 1878–1884.
Fresno River near Knowles, Cal., 1911–
Nelder Creek near Fresno Flats, 1910–
North Fork of Fresno River near Sugar Pine, Cal., 1910–
Chowchilla Creek at base of foothills, near Buchanan, Cal., 1878–1884.
Mariposa Creek at base of foothills, Mariposa County, Cal., 1878–1884.
Bear Creek at base of foothills, Merced County, Cal., 1878–1884.
Merced River at Yosemite, Cal., 1904–1909; 1912–
Merced River near Merced Falls, Cal., 1901–
Merced River at Merced Falls, Cal., 1878–1884.
Merced River near Newman, Cal., 1912.
Tenaya Creek near Yosemite, Cal., 1904–1909; 1912–
Yosemite Creek at Yosemite, Cal., 1904–1909; 1912–
South Fork of Merced River at Wawona, Cal., 1910–
Big Creek near Wawona, Cal., 1910–11.
Tuolumne River at Hetch Hetchy Valley dam site, 1901.
Tuolumne River near Lagrange, Cal., 1895–
Modesto canal near Lagrange, Cal., 1903–
Turlock canal near Lagrange, Cal., 1899–
Lagrange (Yosemite) Water & Power Co.'s canal near Lagrange, Cal., 1908–
Tuolumne River at Modesto, Cal., 1878–1884; 1891–1897.
Cherry River at Eleanor trail crossing, 1901.
Eleanor Creek at Eleanor trail crossing, 1901.
Jawbone Creek near Tuolumne, Cal., 1910–
Corral Creek near Groveland, Cal., 1910–
South Fork of Tuolumne River near Groveland, Cal., 1910–
Clavey River near Tuolumne, Cal., 1910–
Indian Creek near Tuolumne, Cal., 1910–11.
North Fork of Tuolumne River near Tuolumne, Cal., 1910–11.
Hunter Creek near Tuolumne, Cal., 1910–
Stanislaus River at Knights Ferry, Cal., 1903–
Stanislaus and San Joaquin Water Co.'s canal at Knights Ferry, Cal., 1904–

San Joaquin River tributaries—Continued.
Stanislaus River at Oakdale, Cal., 1878–1884; 1895–1900.
Middle Fork of Stanislaus River at Sand Bar Flat, near Avery, Cal., 1905–
Relief Creek near Baker Station, Cal., 1910–
Rose Creek near Jupiter, Cal., 1910–
Knight Creek near Jupiter, Cal., 1910–
South Fork of Stanislaus River near Confidence, Cal., 1911–
South Fork of Stanislaus River near Columbia, Cal., 1910–
Calaveras River at Jenny Lind, Cal., 1907–
Calaveras River near Bellota, Cal., 1878–1884.
Mokelumne River at Electra, Cal., 1901; 1903–
Mokelumne River at Lone Star Mill, Cal., 1878–1884.
Mokelumne River near Clements, Cal., 1904–
Mokelumne River at Lodi, Cal., 1891.
Middle Fork of Mokelumne River at West Point, Cal., 1911–
South Fork of Mokelumne River near Railroad Flat, Cal., 1911–
Licking Fork of Mokelumne River near Railroad Flat, Cal., 1911–
Dry Creek near Ione, Cal., 1911–12.
Dry Creek at base of foothills, San Joaquin County, Cal., 1878–1884.
North Fork of Cosumnes River (head of Cosumnes River) near Eldorado, Cal., 1911–
North Fork of Cosumnes River near Pleasant Valley, Cal., 1906–7.
Cosumnes River at Michigan Bar, Cal., 1907–
Cosumnes River below Michigan Bar, Cal., 1878–1884.
Sly Park Creek at Park, Cal., 1906.

Sacramento River basin.

Sacramento River at Castella, Cal., 1910–
Sacramento River at Antler, Cal., 1910–11.
Sacramento River at Jellys Ferry, Cal., 1895–1902.
Sacramento River near Red Bluff, Cal., 1902–
Sacramento River at Red Bluff, Cal., 1894–1896.
Sacramento River at Collinsville, Cal., 1878–1885.
Pit River near Canby, Cal., 1904–5.
Pit River near Bieber, Cal., 1904–1908.
Pit River at Henderson, Cal., 1910–
Pit River near Ydalpom, Cal., 1910–
Goose Lake:
Drews Creek near Lakeview, Oreg., 1909–
Dog Creek near Lakeview, Oreg., 1912–
Cottonwood Creek near Lakeview, Oreg., 1908–
Thomas Creek near Lakeview, Oreg., 1912–
South Fork of Pit River near Ivy, Cal., 1904–5.
West Valley Creek, near Likely, Cal., 1904–5.
Ash Creek at Adin, Cal., 1904–5.
Fall River at Fall River mills, Cal., 1912–
Hat Creek at Hawkin's ranch near Hat Creek, Cal., 1911–
Hat Creek at Hat Creek, Cal., 1910–
Rising River near Cassel, Cal., 1911–
Burney Creek near Burney, Cal., 1911–

Sacramento River tributaries—Continued.
Pit River tributaries—Continued.
Kosk Creek near Henderson, Cal., 1910–
Montgomery Creek at Montgomery Creek, Cal., 1911–
Squaw Creek near Ydalpom, Cal., 1911–
McCloud River near Gregory, Cal., 1902–1908.
McCloud River at Baird, Cal., 1910–
Clear Creek near Shasta, Cal., 1911–
Cow Creek at Millville, Cal., 1911–
Clover Creek at Millville, Cal., 1911–
Little Cow Creek at Palo Cedro, Cal., 1911–
Bear Creek near Millville, Cal., 1911–
Cottonwood Creek:
North Fork of Cottonwood Creek at Ono, Cal., 1907–
Mill Creek near Los Molinos, Cal., 1909–
Deer Creek near Vina, Cal., 1911–
Stony Creek near Fruto, Cal., 1901–1912.
Little Stony Creek near Lodoga, Cal., 1907–
Feather River, North Fork (head of Feather River) above Prattville, Cal., 1905–1907.
Feather River, North Fork, below Prattville, Cal., 1905–
Feather River, North Fork, at Big Bar, Cal., 1911–
Feather River, North Fork, at Big Bend, Cal., 1905–1908.
Feather River at Oroville, Cal., 1902–
Hamilton Branch near Prattville, Cal., 1905–1907.
Butt Creek at Butte Valley, Cal., 1905–
Indian Creek near Crescent Mills, Cal., 1906–1909; 1911–
Spanish Creek at Keddie, Cal., 1911–
Middle Fork of Feather River at Cromberg, Cal., 1910–
Middle Fork of Feather River near Oroville, Cal., 1911–
Grizzly Creek near Beckwith, Cal., 1905–6.
South Fork of Feather River at Enterprise, Cal., 1911–
Palermo Land & Water Co.'s canal at Enterprise, Cal., 1911–
Yuba River, Middle Fork (head of Yuba River) at Freeman's bridge near North San Juan, Cal., 1900.
Yuba River, Middle Fork, near North San Juan, Cal., 1910–
Yuba River near Smartsville, Cal., 1903–
Yuba River at Parks Bar bridge, near Smartsville, Cal., 1900.
Oregon Creek (tributary to Middle Fork of Yuba) near North San Juan, Cal., 1910–
North Fork of Yuba River near Sierra City, Cal., 1911–
North Fork of Yuba River at Goodyear Bar, Cal., 1910–
North Fork of Yuba River near North San Juan, Cal., 1900.
North Fork of North Fork of Yuba River at Downieville, Cal., 1910–
Rock Creek at Goodyear Bar, Cal., 1910–
Goodyear Creek at Goodyear Bar, Cal., 1910–
Bear River and Pacific Gas & Electric Co.'s power canal near Colfax, Cal., 1911–
Bear River at Van Trent, Cal., 1904–
American River, North Fork (head of American River) near Colfax, Cal., 1911–

Sacramento River tributaries—Continued.
American River at Fairoaks, Cal., 1904–
Middle Fork of American River near East Auburn, Cal., 1911–
Rubicon River at Rubicon Springs, Cal., 1910–1912.
Rubicon River near Quintette, Cal., 1909–1912.
Little Rubicon River near Rubicon Springs, Cal., 1910–11.
Little South Fork of Rubicon River at sawmill near Quintette, Cal., 1910–1912.
Little South Fork of Rubicon River below Gerlé Creek near Quintette, Cal., 1910–1912.
Little South Fork of Rubicon River at mouth near Quintette, Cal., 1909–1911.
Little South Fork ditch at sawmill near Quintette, Cal., 1910–1912.
Gerlé Creek near Rubicon Springs, Cal., 1910–1912.
Pilot Creek near Quintette, Cal., 1910–1912.
Pilot Creek ditch near Quintette, Cal., 1910–1912.
South Fork of American River at Kyburz, Cal., 1906–7.
South Fork of American River near Kyburz, Cal., 1906.
South Fork of American River below Kyburz, Cal., 1907.
South Fork of American River near Placerville, Cal., 1911–
Clear Lake in Lake County, Cal., 1874–1900.
Cache Creek at Lower Lake, Cal., 1901–
Cache Creek at Yolo, Cal., 1903–
Putah Creek near Guenoc, Cal., 1904–1906.
Putah Creek at Winters, Cal., 1905–

STREAMS NORTH OF SAN FRANCISCO BAY.

Russian River basin.

Russian River near Ukiah, Cal., 1911–
Russian River at Geyserville, Cal., 1910–
East Fork of Russian River near Ukiah, Cal., 1911–

Mattole River basin.

Mattole River near Petrolia, Cal., 1911–

Eel River basin.

South Eel River (main stream) at Hearst, Cal., 1910–
Eel River at Two Rivers (near Laytonville), Cal., 1911–
Eel River at Scotia, Cal., 1910–
Middle Eel River near Covelo, Cal., 1911–
South Fork of Eel River at Garberville, Cal., 1911–
Van Duzen River at Bridgeville, Cal., 1911–
Yager Creek at Carlotta, Cal., 1911–

Mad River basin.

Mad River near Arcata, Cal., 1910–

Redwood Creek basin.

Redwood Creek near Korbel, Cal., 1911–
Redwood Creek at Orick, Cal., 1911–

Klamath River basin.

Williamson River (head of Klamath River) above Spring Creek, near Chiloquin, Oreg., 1908–1910; 1912–
Williamson River at Chiloquin, Oreg., 1911–
Upper Klamath Lake near Klamath Falls, Oreg., 1904–
Link River at Klamath Falls, Oreg., 1904–
Lower Klamath Lake near Brownell, Cal., 1912–
Klamath River below Klamath Falls, Oreg., 1907–1909.
Klamath River at Keno, Oreg., 1904–
Klamath River near Happy Camp, Cal., 1911–
Klamath River near Requa, Cal., 1910–
Miller Creek near Crescent, Oreg., 1911–
Sprague River near Yainax, Oreg., 1912–
Sprague River at Chiloquin, Oreg., 1911–
Sycan River near Silverlake, Oreg., 1905–6.
Sycan River near Yainax, Oreg., 1911–
Wood River at Fort Klamath, Oreg., 1911–
Fourmile Creek near Odessa, Oreg., 1912.
Lost River near Clear Lake, Cal., 1904–1909.
Lost River at Olene, Oreg., 1904; 1907–1912.
Lost River at Wilson Bridge near Olene, Oreg., 1912.
Lost River near Merrill, Oreg., 1904–1909.
Tule Lake near Merrill, Oreg., 1904–1912.
Miller Creek near Lorella, Oreg., 1909–
Shasta River near Montague, Cal., 1911–
East Fork of Scott River (head of Scott River) near Callahan, Cal., 1910–1912.
Scott River at Callahan, Cal., 1911–
Scott River near Scott Bar, Cal., 1911–
Indian Creek near Happy Camp, Cal., 1911–
Reeve-Davis Consolidated Mining Co.'s flume near Happy Camp, Cal., 1911–
Salmon River at Somesbar, Cal., 1911–
Trinity River near Trinity Center, Cal., 1910–
Trinity River at Lewiston, Cal., 1911–
Trinity River near China Flat, Cal., 1911–
Trinity River at Hoopa, Cal., 1911–
Coffee Creek at Coffee, Cal., 1910–
East Fork of Trinity River near Trinity Center, Cal., 1910–
Swift Creek near Trinity Center, Cal., 1910–
North Fork of Trinity River at Helena, Cal., 1911–
South Fork of Trinity River near China Flat, Cal., 1911–

Smith River basin.

Smith River, Middle Fork (head of Smith River) near Crescent City, Cal., 1911–
North Fork of Smith River near Crescent City, Cal., 1911–
South Fork of Smith River near Crescent City, Cal., 1911–

REPORTS ON WATER RESOURCES OF THE PACIFIC SLOPE OF CALIFORNIA.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

*17. Irrigation near Bakersfield, Cal., by C. E. Grunsky. 1898. 96 pp., 16 pls.

*18. Irrigation near Fresno, Cal., by C. E. Grunsky. 1898. 94 pp., 14 pls. 10c.

*19. Irrigation near Merced, Cal., by C. E. Grunsky. 1899. 59 pp., 11 pls. 15c.

Water-Supply Papers 17, 18, and 19 discuss the development of irrigation in the San Joaquin Valley, outline physiographic features, and give history of the various irrigation districts. Chiefly of historic interest as indicated by dates of publication.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

Describes the location and construction of various types of canals for irrigation.

45. Water storage on Cache Creek, Cal., by A. E. Chandler. 1901. 48 pp., 10 pls. 15c.

Discusses topography, precipitation, stream measurements, underground waters, and irrigation works in Cache Creek basin; includes description of Clear Lake.

46. Physical characteristics of Kern River, Cal., by F. H. Olmsted, and reconnaissance of Yuba River, Cal., by Marsden Manson. 1901. 57 pp., 8 pls. 10c.

Describes topography of Kern River basin, gives estimates of daily and monthly discharge, and discusses possible utilization of storage sites and development of power. The second paper in the report gives similar data for Yuba River (tributary through Feather River to the Sacramento).

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

No. 57 contains information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc.

*58. Storage of water on Kings River, Cal., by J. B. Lippincott. 1902. 100 pp., 32 pls. 15c.

Discusses physical features, rainfall, stream flow, evaporation, and seepage and power development; includes chapter (by Lewis A. Hicks) on the generation and transmission of electric power and installation of pumping plants.

*59. Development and application of water near San Bernardino, Colton, and Riverside, Cal., Part I, by J. B. Lippincott. 1902. 95 pp., 11 pls.

*60. Development and application of water near San Bernardino, Colton, and Riverside, Cal., Part II, by J. B. Lippincott. 1902. 96–140 pp. 15c.

Nos. 59 and 60 describe topography, soil, climate, crops, canals, wells, and pumping plants; discuss briefly the manufacture of Portland cement in southern California.

*81. California hydrography, by J. B. Lippincott. 1903. 448 pp., 1 pl. 25c.

A collection of published records of stream flow "hitherto much scattered, some of them out of print and difficult to secure," brought together as a book of reference for engineers and irrigators.

86. Storage reservoirs on Stony Creek, Cal., by Burt Cole. 1903. 62 pp., 16 pls. 15c.

Discusses briefly water supply of Glenn County, as related to population, industry, irrigation districts, the proposed Stony Creek forest reserve, and storage sites on Grindstone, Salt, Briscoe, and Stony Creeks.

89. Water resources of the Salinas Valley, Cal., by Homer Hamlin. 1904. 91 pp., 12 pls. 15c.

Describes briefly the geography, topography, general and economic geology, climate, water supply, and irrigation of the Salinas Valley.

*112. Underflow tests in the drainage basin of Los Angeles River, by Homer Hamlin. 1905. 55 pp., 7 pls. 5c.

Discusses conditions under which ground water occurs in arid regions, and fluctuations in water level; describes machinery and methods used in sinking test wells and the results obtained at each station.

116. Water problems of Santa Barbara, Cal., by J. B. Lippincott. 1905. 99 pp., 8 pls. 10c.

Reviews earlier work in Santa Barbara region and describes near-by and distant water supplies, including Ventura and Santa Ynez rivers; discusses the quality of the water of the Santa Ynez (giving analyses) and the available reservoir sites.

*137. Development of underground waters in the eastern coastal-plain region of southern California, by W. C. Mendenhall. 1905. 140 pp., 7 pls. 35c.

*138. Development of underground waters in the central coastal-plain region of southern California, by W. C. Mendenhall. 1905. 162 pp., 5 pls. 25c.

*139. Development of underground waters in the western coastal-plain region of southern California, by W. C. Mendenhall. 1905. 105 pp., 8 pls. 25c.

Three reports discussing the topography, crops, irrigation systems, and wells, and the effects of development and drought on changes in ground-water level. The area covered by these reports includes the Anaheim, Santa Ana, Downey, Las Bolsas, Santa Monica, and Redondo quadrangles in Orange and Los Angeles counties.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Contains chapters on measurements of underflow of Rio Hondo and San Gabriel River and at the Narrows of Mohave River.

142. The hydrology of San Bernardino Valley, Cal., by W. C. Mendenhall. 1905. 124 pp., 12 pls. 25c.

Discusses rainfall, soils, artesian areas, temperature, and chemical character of the ground waters, gives tables of flow of Santa Ana River, Mill Creek, and other streams, and lists of wells in Redlands and San Bernardino quadrangles.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

A brief account of the organization of the hydrographic (water resources) branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service.

A report on "Underground waters of southern California," by W. C. Mendenhall. Gives an account of early irrigation by use of surface waters, the development of artesian wells for irrigation, and discusses the origin, distribution, and character of the artesian waters, the causes of fluctuations in the supply, and the need of moderation in use.

146. Proceedings of second conference, etc.—Continued.

A report on the Klamath project, by J. B. Lippincott. Describes Klamath River and its principal tributaries and Lost River and Tule Lake. Describes also the irrigable lands in Butte Valley around Tule and Lower Klamath Lakes and in the Klamath Indian Reservation.

A brief report on "Pumping underground water in southern California," by F. C. Finkle. Discusses underground reservoirs, the source, extent, and methods of replenishment of the water supply, and describes the efficiency of pumps and the development of electric power for pumping.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c. Contains:

Sacramento River flood, California, from report of S. G. Bennett. Gives accounts of flood on Sacramento River; describes briefly the streams of the basin, precipitation, discharge, damages, and prevention of future losses.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other valuable information concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates of flood flow and frequency (p. 85) for Tuolumne River at Lagrange, Kern River at Rio Brava Ranch, and Kings River at Sanger; contains also index to literature on floods on American streams.

*213. Surface water supply of California, 1906, by W. B. Clapp, with a section on ground-water levels in southern California, by W. C. Mendenhall. 1907. 219 pp., 4 pls. 25c.

Gives the results of a series of measurements of the fluctuation of ground-water levels made during 1904, 1905, and 1906. The wells were "so selected that they would be evenly distributed over the various basins which together make up the lowland areas of southern California, and would thus give an adequate basis for conclusions as to conditions in each of these basins."

*219. Ground waters and irrigation enterprises in the foothill belt, southern California, by W. C. Mendenhall. 1908. 180 pp., 9 pls. 50c.

Describes the general geologic conditions, physical features, rainfall, storage facilities, character and condition of subterranean reservoirs, measures for conservation of waters, and the ground waters by districts; discusses fluctuation in ground-water levels and gives results of measurements; describes irrigation enterprises and systems and gives statistics of wells.

*222. Preliminary report on the ground waters of San Joaquin Valley, Cal., by W. C. Mendenhall. 1908. 52 pp., 1 pl. 10c.

Describes the geography of the valley, the rocks, soils, surface waters, and the origin, circulation, quantity accessibility, and development of the underground waters; gives notes on water supply by counties.

237. The quality of the surface waters of California, by Walton Van Winkle and F. M. Eaton. 1910. 142 pp., 1 pl. 20c.

Describes geography, climate, industrial development, and drainage, and gives results of mineral analyses of the river waters.

251. Surface-water supply of the United States, 1907–8, Part XI, California. 35c.

Contains a section (pp. 338–348) on "fluctuations in ground-water levels in the valley of southern California." The measurements here published form a continuation of those published in Water-Supply Paper 213. They were made at irregular intervals during 1907–8 on the same wells that were measured during the earlier period, except for a few wells that had become inaccessible.

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274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial applicaton of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Sacramento, Pit, Feather, Yuba, and American rivers, Stony and Putah creeks, and Tuolumne River; also of Link River, Oreg., in Klamath River basin.

295. Gazetteer of surface waters of California, Part I: Sacramento River basin, by B. D. Wood. 1912. 99 pp. 10c.

*296. Gazetteer of surface waters of California, Part II: San Joaquin River basin, by B. D. Wood. 1912. 102 pp. 10c.

*297. Gazetteer of surface waters of California, Part III: Pacific coast and Great Basin streams, by B. D. Wood. 1913. 244 pp. 20c.

Nos. 295–297 embrace descriptions of streams and lakes named on best available maps of California.

*298. Water resources of California, Part I: Stream measurements in Sacramento River basin, by H. D. McGlashan and F. F. Henshaw. 1912. 411 pp., 8 pls. 30c.

*299. Water resources of California, Part II: Stream measurements in San Joaquin River basin, by H. D. McGlashan and H. J. Dean. 1912. 439 pp., 7 pls. 50c.

*300. Water resources of California, Part III: Stream measurements in the Great Basin and Pacific coast river basins, by H. D. McGlashan and H. J. Dean. 1913. 956 pp., 4 pls. 55c.

Nos. 298–300 comprise all data concerning stream flow in California available up to September 30, 1912. The reports describe the drainage basins, precipitation, temperature, and forests, and give the results of work at gaging stations. See also Nos. 295–297.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form. Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II, Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir rites and irrigable lands, field and office methods, and brief descriptions of the topography of some of of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, pp. xiv, 395, 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*The arid lands, pp. 201–289. Includes statement of the Director to the House Committee on Irrigation, extracts from the constitutions of States relating to irrigation.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

*Report upon the location and survey of reservoir sites during the fiscal year ending June 30, 1891, by A. H. Thompson, pp. 1–212, Pls. LIV–LVII. Describes reservoir sites on Yuba River, Deer Creek, Mokelumne River, Pacific Valley Creek, Big Canyon Creek, Hull Creek, Granite Lake, Cherry River, Lake Vernon, Big Meadows north of Hetch Hetchy Valley, and in Hetch Hetchy, California; for each reservoir site gives the location, height of dam, area inclosed by top contour, approximate contents of reservoir, position of irrigable lands, and areas of segregated lands.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, Pls. CXLVII–CLXXXII. Describes results of surveys of high Sierra reservoirs—Bear Valley, Kennedy's Meadow, Kennedy's Lake, Lake Eleanor, Tuolumne Meadow, Lake Tenaya, and Lake Yosemite—and of Bear Lake, Cal.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95. 4 parts. *Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

*The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Eighteenth Annual Report, United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. 5 parts in 6 volumes. *Pt. IV, Hydrography, pp. x, 756, 102 pls. $1.75. Contains:

*Reservoirs for irrigation, by J. D. Schuyler, pp. 617–740, Pls. XLVII–CII. Describes rock fill, masonry, and earthenware dams, and hydraulic dam construction in California, and projected reservoirs; gives tables for reservoir capacities and areas.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V, *Pt. V, Forest Reserves, pp. xix, 498, 159 pls., 8 maps in separate case. $2.80. Contains:

*The San Gabriel Forest Reserve, by J. B. Leiberg, pp. 411–428, Pls. CXLIII–CXLVI. The San Bernardino Forest Reserve, by J. B. Leiberg, pp. 429–454, Pls. CXLVII–CLIII. The San Jacinto Forest Reserve, by J. B. Leiberg, pp. 455–478, Pls. CLIV–CLIX. Describes general topographic features of forest reserves and drainage, part of which is by streams tributary to the Pacific, and part by streams that are lost in the sands of the Mohave and other deserts.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Vetch. 1905. 106 pp. 10c.

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in California, and detailed records of wells in Monterey and San Diego counties, California. These wells were selected because they give definite stratigraphic information.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 209 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in California; and detailed records of wells in Alameda, Fresno, Kern, Orange, San Luis Obispo, Santa Clara, Tulare, and Ventura counties. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the condi-

[1] Index maps showing areas in California covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

tions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive, also to the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell for 50 cents a copy. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*17. Marysville folio.

Includes, under "Economic geology," a section on the water supply.

*39. Truckee folio.

Describes the general and economic geology of an area extending westward and northward from Truckee Lake, drained by streams a part of which flow through Yuba and American rivers to the Sacramento, and part through Lake Tahoe to the Great Basin; discusses the topography and geology and, under "Economic geology," the mineral springs which occur abundantly throughout the area.

*66. Colfax folio.

Under "General features" describes the streams and hydraulic mining ditches, and under "Economic geology" gives a brief paragraph on the water supply, mentioning the springs.

101. San Luis folio.

Under "Economic geology" describes mineral springs.

*138. Redding folio.

Describes the relief and drainage, the stratigraphic and historical geology and, under "Economic geology," discusses briefly irrigation and artesian water.

*163. Santa Cruz folio.

Under "Economic geology" describes the water resources, including streams, springs, flowing wells, and reservoirs.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the Pacific slope of California are the reports of the State engineer and surveyor, the State conservation commission, and the State water commission.

The following reports deserve special mention:

Hall, W. H., Physical data and statistics of California, 1886.

Report of the Commissioner of Public Works to the Governor of California, 1895.

Report of the State Water Commission of California, 1912.

Part XII. NORTH PACIFIC SLOPE DRAINAGE BASINS.

PRINCIPAL STREAMS.

The largest rivers discharging into the Pacific Ocean in Oregon and Washington are Rogue, Umpqua, and Columbia rivers and streams that reach the ocean through Puget Sound. The principal tributaries of the Columbia are Clark Fork, Kootenai, Spokane, Wenatchee, Yakima, Snake, Bruneau, Boise, Walla Walla, Umatilla, John Day, Deschutes, Hood, and Willamette rivers. Nisqually, Puyallup, White, Snoqualmie, and Skagit rivers flow into Puget Sound. The streams of this division drain wholly or in part the States of Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 168.)

GAGING STATIONS.

Note.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinunce.

BETWEEN KLAMATH RIVER AND COLUMBIA RIVER.

Rogue River, North Fork (head of Rogue River) at Prospect, Oreg., 1907–
Rogue River at Trail, Oreg., 1910–
Rogue River near Tolo, Oreg., 1905-
Rogue River near Galice, Oreg., 1906.
Mill Creek near Prospect, Oreg., 1910.
Big Butte Creek, South Fork (head of Big Butte Creek), at Butte Falls, Oreg., 1910–11.
Little Butte Creek, South Fork (head of Little Butte Creek), near Lake Creek, Oreg., 1910–
Little Butte Creek near Eagle Point, Oreg., 1907–
North Fork of Little Butte Creek near Lake Creek, Oreg., 1911–
Bear Creek at Talent, Oreg., 1907–
Applegate Creek near Buncom, Oreg., 1911–
Applegate Creek at Murphy, Oreg., 1907–1910.
Cameron ditch near Buncom, Oreg., 1911–
Umpqua River, North Fork of South Fork (head of Umpqua River), near Tiller, Oreg., 1910–11.

Umpqua River, South Fork, near Brockway, Oreg., 1905–
Umpqua River near Elkton, Oreg., 1905–
Cow Creek at Riddle, Oreg., 1911–
North Fork of Umpqua River near Hoaglin, Oreg., 1910–
North Fork of Umpqua River near Oak Creek and Winchester, Oreg., 1905–
Mill Creek near Ash, Oreg., 1907–
Siletz River at Siletz, Oreg., 1905–

COLUMBIA RIVER BASIN.

Columbia River at Wenatchee, Wash., 1910.
Columbia River near Julia, Wash., 1905.
Columbia River at Hanford, Wash., 1910.
Columbia River at Pasco, Wash., 1904–1910.
Columbia River at Cascade Locks and The Dalles, Oreg., 1879–
Kootenai River at Libby, Mont., 1910–
Kootenai River near Bonners Ferry, Idaho, 1904.
Kootenai River near Porthill, Idaho, 1904.
Callahan Creek near Troy, Mont., 1911–
Yaak Creek near Troy, Mont., 1910–
Moyie River near Snyder, Idaho, 1911–
Clark Fork at Missoula, Mont., 1898–1907.
Clark Fork at St. Regis, Mont., 1910–
Clark Fork near Plains, Mont., 1910–
Clark Fork at Priest River, Idaho, 1903–1905.
Clark Fork at Newport, Wash., 1904–1910.
Clark Fork at Metaline, Wash., 1908–1910.
Racetrack Creek near Anaconda, Mont., 1911–
Little Blackfoot River and ditch near Elliston, Mont., 1910–
Rock Creek near Quigley, Mont., 1910–
Big Blackfoot River at Bonner, Mont., 1898–1905.
Rattlesnake Creek at Missoula, Mont., 1898–1900.
Bitterroot River, West Fork (head of Bitterroot River), near Darby, Mont., 1910–
Bitterroot River near Grantsdale, Mont., 1902–1907.
Bitterroot River near Missoula, Mont., 1898–1901; 1903–4.
East Fork of Bitterroot River near Darby, Mont., 1910–
Lolo Creek near Lolo, Mont., 1910–
St. Regis River near St. Regis, Mont., 1910–
Flathead River, North Fork (head of Flathead River) near Columbia Falls, Mont., 1910–
Flathead River at Demersville near Kalispell, Mont., 1910–
Flathead River at Damon's ranch near Kalispell, Mont., 1910–
Flathead River at Keller's ranch near Holt, Mont., 1910–
Flathead Lake (on Flathead River) at Polson, Mont., 1908–
Flathead River near Polson, Mont., 1907–
Middle Fork of Flathead River at Belton, Mont., 1910–
Lake McDonald outlet at Lake McDonald, Mont., 1912–
South Fork of Flathead River near Columbia Falls, Mont., 1910–
Swan River near Big Fork, Mont., 1910–11.
Stillwater River near Kalispell, Mont., 1906–7.
Whitefish River near Kalispell, Mont., 1906.
Little Bitterroot Creek near Marion, Mont., 1910–

Columbia River tributaries—Continued.
Clark Fork tributaries—Continued.
Flathead River tributaries—Continued.
Little Bitterroot Creek near Hubbart, Mont., 1909–
Little Bitterroot Creek near Dayton, Mont., 1908–9.
Crow Creek near Ronan, Mont., 1906–
Crow Creek at Lozeau's ranch near Ronan, Mont., 1911–
Mud Creek near Ronan, Mont., 1908–1910.
Mission Creek near St. Ignatius, Mont., 1906–
Dry Creek near St. Ignatius, Mont., 1908–
Post Creek near Ronan, Mont., 1906–1911.
Post Creek near St. Ignatius, Mont., 1912.
Jocko River, North Fork (head of Jocko River), near Jocko, Mont., 1912–
Jocko River near Jocko, Mont., 1908–
Jocko River at Ravalli, Mont., 1906–1911.
Falls Creek near Jocko, Mont., 1912–
South Fork of Jocko River near Jocko, Mont., 1912–
Middle Fork of Jocko River near Jocko, Mont., 1912–
Big Knife Creek near Jocko, Mont., 1908–
Agency Creek near Jocko, Mont., 1908–
Blodgett Creek near Jocko, Mont., 1909–10.
Finley Creek near Jocko, Mont., 1908–
East Finley Creek near Jocko, Mont., 1908–
Indian ditch near Jocko, Mont., 1908–
Valley Creek near Ravalli, Mont., 1908–1911.
Revais Creek near Dixon, Mont., 1911–
Thompson River near Thompson Falls, Mont., 1911–
Prospect Creek near Thompson Falls, Mont., 1911–
Priest River at Priest Lake near Coolin, Idaho, 1912–
Priest River at Falk's ranch near Priest River, Idaho, 1911–
Priest River near Priest River, Idaho, 1903–1905; 1910–11.
Sullivan Lake near Metaline, Wash., 1912–
Sullivan Creek near Metaline, Wash., 1912–
Kettle River at Curlew, Wash., 1911–
Cœur d'Alene River, North Fork (head of Cœur d'Alene River and through Cœur d'Alene Lake of Spokane River) at Prichard, Idaho, 1911–
Cœur d'Alene River near Enaville, Idaho, 1911–12.
Cœur d'Alene River at Cataldo, Idaho, 1911–
Cœur d'Alene Lake at Cœur d'Alene, Idaho, 1903–1910.
Spokane River near Trent, Wash., 1912–
Spokane River at Washington Water Power Co. dam at Spokane, Wash., 1891–1896.
Spokane River at Spokane, Wash., 1896–
Spokane Valley Land & Water Co. canal near Post Falls, Wash., 1911–
Spokane River near Long Lake, Wash., 1912–
Little North Fork of Cœur d'Alene River near Enaville, Idaho, 1911–
St. Joe River at Avery, Idaho, 1911–
St. Joe River near Calder, Idaho, 1911–
Latah [Hangman] Creek at and near Tekoa, Wash., 1904–1905.
North Fork of Latah Creek near Spokane, Wash., 1904–5.
Little Spokane River near Spokane, Wash., 1903–1905; 1911–
San Poil River at Keller, Wash., 1911–

Columbia River tributaries—Continued.
Nespelem River near Nespelem, Wash., 1911–
Okanogan River at Okanogan, Wash., 1911–
Similkameen River near Oroville, Wash., 1911–
Sinlahekin Creek near Loomis, Wash., 1903–1905.
Johnson Creek near Riverside, Wash., 1903–1907.
Salmon Creek near Okanogan (Malott), Wash., 1903–
Methow River at Winthrop, Wash., 1912–
Methow River at Pateros, Wash., 1903–
Twisp River near Twisp, Wash., 1912–
Stehekin River (head of Chelan River) near Stehekin, Wash., 1910–
Chelan Lake at Lakeside, Wash., 1897–1899; 1905.
Chelan Lake at Chelan, Wash., 1910–
Chelan River at Chelan, Wash., 1903–
Railroad Creek at Lucerne, Wash., 1910–
Entiat River at Entiat, Wash., 1910–
Wenatchee River near Chiwaukum, Wash., 1912–
Wenatchee River near Leavenworth, Wash., 1910–
Wenatchee River at Sherman Spur, above Cashmere, near Dryden, Wash., 1909–10.
Wenatchee River at Cashmere, Wash., 1904–
Wenatchee River at Dryden, Wash., 1912–
Wenatchee River at Wenatchee, Wash., 1897.
Wenatchee Valley canal at Dryden, Wash., 1912–
White River near Chiwaukum, Wash., 1911–
Nason Creek near Nason, Wash., 1911–
Chiwawa River near Leavenworth, Wash., 1911–
Chiwaukum Creek near Chiwaukum, Wash., 1911.
Icicle Creek near Leavenworth, Wash., 1911–
Peshastin Creek near Leavenworth, Wash., 1911–
Crab Creek at Wilson Creek, Wash., 1904.
Crab Creek near Adrian, Wash., 1910–
Crab Creek near Ephrata, Wash., 1909.
Moses Lake at Moses Lake, Wash., 1909–
Crab Creek near Warden, Wash., 1909–
Rockyford Creek near Ephrata, Wash., 1910–
Keechelus Lake (on Yakima River) near Martin, Wash., 1906–
Yakima River near Martin, Wash., 1903–
Yakima River at Easton, Wash., 1904; 1910–
Yakima River at Clealum, Wash., 1906–
Yakima River at Umtanum, Wash, 1906–
Yakima River at Selah Gap, near North Yakima, Wash., 1897–8; 1904–5; 1911–
Yakima River at Union Gap, near Yakima, Wash., 1893–
Yakima River near Wapato, Wash., 1908–
Yakima River at Mabton, Wash., 1911–
Yakima River at Prosser, Wash., 1904–1906.
Yakima River at Kiona, Wash., 1895–
Yakima River near Richland, Wash., 1906–1911.
Cabin Creek near Easton, Wash., 1909–
Kachess Lake (on Kachess River) near Easton, Wash., 1905–
Kachess Lake evaporation records, 1907–1910.
Kachess River near Easton, Wash., 1903–
Big Creek near Clealum, Wash., 1909.

Columbia River tributaries—Continued.
Yakima River tributaries—Continued.
Clealum River, North Fork (head of Clealum River), at Galena, Wash., 1907; 1911.
Clealum Lake near Roslyn, Wash., 1906–
Clealum River near Roslyn, Wash., 1903–
Teanaway River below Forks near Clealum, Wash., 1911–
Teanaway River near Clealum, Wash., 1909–
Swauk Creek near Clealum, Wash., 1909–
Taneum Creek near Thorp, Wash., 1909–
Manastash Creek near Ellensburg, Wash., 1909–
Wilson Creek near Thrall, Wash., 1911.
Wenas Creek near Selah, Wash., 1909–1912.
Naches River at Anderson's ranch near Nile, Wash., 1909–
Naches River at Oak Flat near Nile, Wash., 1904–
Naches River below Tieton River near Naches, Wash., 1905; 1909–
Naches River at North Yakima, Wash., 1893–
Bumping Lake (on Bumping River) near Nile, Wash., 1909–
Bumping River at Bumping Lake near Nile, Wash., 1906; 1909–
American River near Nile, Wash., 1909–
Tieton River at McAllister Meadows, near Naches, Wash., 1908–
Tieton River at headworks of Tieton canal, near Naches, Wash., 1906–
Tieton River at Cobb's ranch, near Naches, Wash., 1902–
Atanum Creek, North Fork (head of Atanum Creek) near Tampico, Wash., 1907–
Atanum Creek at The Narrows, near Tampico, Wash., 1908–
Atanum Creek near Yakima, Wash., 1904; 1907–
South Fork of Atanum Creek near Tampico, Wash., 1907–
Toppenish Creek near Fort Simcoe, Wash., 1909–
Toppenish Creek near White Swan (Wapato), Wash., 1909–
Toppenish Creek at railway bridge near Toppenish, Wash., 1894–1896.
Toppenish Creek near Toppenish, Wash., 1908–9.
Toppenish Creek at Alfalfa, Wash., 1909–
Simcoe Creek near Fort Simcoe, Wash., 1909–
Satus Creek near Toppenish, Wash., 1908–
Satus Creek near Alfalfa, Wash., 1905.
Satus Creek near Satus, Wash., 1894–1896.

Canals in Yakima River basin.

Diversions in Kittitas Valley:
Cascade canal near Thorp, Wash., 1905; 1909.
West Kittitas canal near Thorp, Wash., 1904–5; 1909–
Ellensburg Water Co. canal near Ellensburg, Wash., 1904; 1909.
Town canal near Ellensburg, Wash., 1904–5.
Olson canal near Ellensburg, Wash., 1905; 1909.
Bull canal near Ellensburg, Wash., 1909.
Diversions in Yakima and Moxee valleys:
Selah-Moxee canal near Selah, Wash., 1904; 1909.
Taylor canal near Selah, Wash., 1905; 1909.
Moxee canal near North Yakima, Wash., 1904–5; 1909.
Hubbard canal near North Yakima, Wash., 1904–5; 1909.

Columbia River tributaries—Continued.
Yakima River tributaries—Continued.
Diversions in Yakima and Moxee valleys—Continued.
Fowler canal near North Yakima, Wash., 1904–5; 1909.
Granger canal near North Yakima, Wash., 1904; 1909.
Indian Reservation diversions:
New Reservation canal near Yakima, Wash., 1904–
Old Reservation canal near Wapato, Wash., 1904–
Sunnyside canal near Wapato, Wash., 1904–
Sunnyside canal wasteways, 1911.
Sunnyside canal at Zillah, Wash., evaporation records, 1907–8.
Gilbert canal near Toppenish, Wash., 1904.
Hatch canal near Toppenish, Wash., 1904.
Diversions from Lower Yakima
Prosser Falls Irrigation Co.'s canal at Prosser, Wash., 1904.
Benton Water Co.'s canal near Kiona, Wash., 1905.
Kiona canal near Kiona, Wash., 1904–5; 1908–9.
Kiona Water Supply Co.'s canal near Kiona, Wash., 1905.
Grosscup canal near Kiona, Wash., 1905.
Kennewick canal near Kennewick, Wash., 1905.
Diversions from Naches River:
Selah Valley canal near Naches, Wash., 1904–5; 1911–
Tieton canal near Naches, Wash., 1910–
Wapatox canal, upper and lower, near Naches, Wash., 1904–5; 1909.
Clark canal near Naches, Wash., 1905; 1909.
Upper Scott canal near Naches, Wash., 1909.
Lowery canal near Naches, Wash., 1905; 1909.
Kelly canal near Naches, Wash., 1909.
Fortune canal near Naches, Wash., 1905; 1909.
Lower Scott canal near Naches, Wash., 1905; 1909.
Gleed canal near Naches, Wash., 1904–5; 1909–1911.
Morrisey canal near Naches, Wash., 1909.
Congdon (Yakima Valley) canal near Naches, Wash., 1904–5; 1909.
White & Leach canal near Naches, Wash., 1905; 1909.
McCormick canal near Naches, Wash., 1905; 1909.
Schuler & Rodenbach canal near North Yakima, Wash., 1909.
Naches-Cowiche canal near North Yakima, Wash., 1904–5.
Power canal at North Yakima, Wash., 1904–5.
Fruitvale-Schanno canal at North Yakima, Wash., 1909.
R. S. & C. canal at North Yakima, Wash., 1909.
Schanno canal at North Yakima, Wash., 1904–5; 1909.
Broadgage canal near North Yakima, Wash., 1904–5; 1909.
Union canal at North Yakima, Wash., 1904; 1909.
North Yakima Town canal at North Yakima, Wash., 1904; 1909.
Jackson Lake (Snake River) near Moran, Wyo., 1908.
Snake River[1] at Moran, Wyo., 1903–
Snake River[1] at Grovant, Wyo., 1899.
Snake River[1] near Lyon, Idaho, 1903–
Snake River[1] near Heise, Idaho, 1910–
Snake River at Idaho Falls, Idaho, 1889–1893.
Snake River near Blackfoot, Idaho, 1910–
Snake River at Neeley, Idaho, 1906–

[1] Decision of United States Geographic Board; formerly called South Fork of Snake River.

Columbia River tributaries—Continued.
Snake River at Howells Ferry near Minidoka, Idaho, 1910–
Snake River near Minidoka, Idaho, 1895–1899; 1901–1910.
Lake Milner (on Snake River) at Milner, Idaho, 1911–
Snake River at Milner, Idaho, 1909–
Snake River near Twin Falls, Idaho, 1912–
Snake River near Hagerman, Idaho, 1912–
Snake River at King Hill, Idaho, 1909–
Snake River at Weiser, Idaho, 1910–
Snake River at Lewiston, Idaho, 1910–
Snake River near Burbank, Wash., 1907–
Pacific Creek near Moran, Wyo., 1906.
Buffalo River near Elk, Wyo., 1906.
Henrys Fork[1] at Warm River, Idaho, 1910–
Henrys Fork near Ora, Idaho, 1902–1909.
Henrys Fork at Ferry, Idaho, 1890.
Henrys Fork near Rexburg, Idaho, 1909–
Warm River near Warm River, Idaho, 1912–
Robinson Creek near Warm River, Idaho, 1912–
Fall River near Marysville, Idaho, 1902–3.
Fall River at Fremont, Idaho, 1904–1909 (replaces Marysville station).
Fall River at Canyon, Idaho, 1890–1901.
Teton River near St. Anthony, Idaho, 1903–1909.
Teton River at Chase's ranch, Idaho, 1890–1893.
Willow Creek near Prospect, Idaho, 1904.
Blackfoot River near Rossfork, Idaho, 1908– (now called "near Henry").
Blackfoot River near Shelley, Idaho, 1909–
Big Lost River near Chilly, Idaho, 1904–1906; 1907–
Big Lost River near Mackay, Idaho, 1903–1906; 1912–
Thousand Springs Creek near Mackay, Idaho, 1912–
Cedar Creek above forks near Mackay, Idaho, 1912–
Cedar Creek below forks near Mackay, Idaho, 1912–
Little Lost River near Clyde, Idaho, 1910–
Birch Creek near Kaufman, Idaho, 1910–
Camas Creek near Hamer, Idaho, 1912–
Portneuf River above reservoir, near Chesterfield, Idaho, 1912–
Portneuf River below reservoir near Chesterfield, Idaho, 1912–
Portneuf River near Pebble, Idaho, 1910–
Portneuf River near McCammon, Idaho, 1896.
Portneuf River at Pocatello, Idaho, 1897–1899; 1912–
Topons Creek near Pebble, Idaho, 1912–
Birch Creek near Downey, Idaho, 1912–
Raft River near Bridge, Idaho, 1909–
Clear Creek near Naf, Idaho, 1910–
Cassia Creek near Conant, Idaho, 1909–
Goose Creek above Trapper Creek near Oakley, Idaho, 1911–
Goose Creek near Oakley, Idaho, 1909–1911.
Trapper Creek near Oakley, Idaho, 1911–
Birch Creek near Oakley, Idaho, 1912–

[1] Decision of United States Geographic Board; formerly called North Fork of Snake River.

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Big Cottonwood Creek near Oakley, Idaho, 1909–
Dry Creek near Artesian City, Idaho, 1912–
Rock Creek near Rock Creek, Idaho 1909–
McMullen Creek near Rock Creek, Idaho, 1910; 1912–
Salmon Falls River near San Jacinto, Nev., 1909–
Salmon Falls River near Twin Falls, Idaho, 1909–10.
Cedar Creek near Roseworth, Idaho, 1909–
Devil Creek near Three Creek, Idaho, 1912–
Big Wood River near Gillet, Idaho, 1904–5.
Big Wood River near Hailey, Idaho, 1889.
Big Wood River near Bellevue, Idaho, 1911–
Big Wood River below Magic Dam near Richfield, Idaho, 1911–
Big Wood River near Shoshone, Idaho, 1905–6; 1908–
Big Wood River at Toponis (Gooding?), Idaho, 1896–1899.
Big Wood River near Bliss, Idaho, 1899.
Little Camas Creek near Little Camas Store, Idaho, 1896.
Malad River[1] near Blaine, Idaho, 1912–
Little Wood River near Carey, Idaho, 1904–5.
Little Wood River near Richfield, Idaho, 1911–
Little Wood River at Toponis (Gooding?), Idaho, 1896–1899.
Dry Creek near Blanche, Idaho, 1912–
Little Canyon Creek at Glenns Ferry, Idaho, 1909–
Alkali Creek near Glenns Ferry, Idaho, 1909–
Cold Spring Creek near Hammett, Idaho, 1909–
Bennett Creek near Hammett, Idaho, 1909–
Bruneau River near Tindall, Idaho, 1910–
Bruneau River near Hot Spring, Idaho, 1909–
Bruneau River near Grandview, Idaho, 1895–1903; 1909–
Sheep Creek near Tindall, Idaho, 1910–
Marys Creek at Tindall, Idaho, 1910–
Louse Creek near Wickahoney, Idaho, 1911.
East Fork of Bruneau River near Hot Spring, Idaho, 1910–
Big Flat Creek near Three Creek, Idaho, 1912–
Cherry Creek near Three Creek, Idaho, 1912–
Three Creek near Three Creek, Idaho, 1912–
Deadwood Creek near Three Creek, Idaho, 1912–
Castle Creek near Castle Creek, Idaho, 1910–11.
Succor Creek near Homedale, Idaho, 1903–1910.
Owyhee River at Owyhee, Oreg., 1890–1896; 1903–
Jordan Creek near Jordan Valley, Oreg., 1911–
Boise River near Twin Springs, Idaho, 1911–
Boise River at Dowling's ranch near Arrowrock (Highland), Idaho, 1911–
Boise River near Highland, Idaho, 1905– (replaces the Boise station).
Boise River near Boise, Idaho, 1894–1904.
Boise River at Caldwell, Idaho, 1895–96.
South Fork of Boise River near Prairie, Idaho, 1911–
Grimes Creek near Centerville, Idaho, 1909–10.
Spring Creek near Boise, Idaho, 1912–
Malheur River above South Fork at Riverside, Oreg., 1906–1910.

[1] Decision of United States Geographic Board; formerly called Camas Creek.

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Malheur River at Riverside, Oreg., 1909–
Malheur River near Harpers ranch, near Westfall, Oreg., 1903–1905.
Malheur River at McLaughlin's bridge, near Vale, Oreg., 1904–1906.
Malheur River at Vale, Oreg., 1890–91; 1895–6; 1903–
Malheur River at Halliday's bridge, near Ontario, Oreg., 1904–5.
South Fork of Malheur River at Riverside, Oreg., 1910–
North Fork of Malheur River near Beulah, Oreg., 1909–
Bully Creek near Westfall, Oreg., 1911–
Bully Creek at Warm Springs near Vale, Oreg., 1903–4; 1905–1907; 1911–
Bully Creek at Vale, Oreg., 1904–5.
Willow Creek near Malheur, Oreg., 1904–5; 1911–
Willow Creek near Brogan, Oreg., 1910–
Willow Creek at Dell, Oreg., 1904–1906.
Cow Creek near Malheur, Oreg., 1912–
Pole Creek near Brogan, Oreg., 1912–
Payette River near Horseshoe Bend, Idaho, 1906–
Payette River at Payette, Idaho, 1895–1897.
North Fork of Payette River at Lardo, Idaho, 1908–
North Fork of Payette River at Van Wyck, Idaho, 1912–
Lake Fork of Payette River near McCall, Idaho, 1909–
Shafer Creek near Horseshoe Bend, Idaho, 1911–
Harris Creek near Horseshoe Bend, Idaho, 1911–
Weiser River near Weiser, Idaho, 1890–91; 1895–1904; 1910–
Weiser River, West Fork, near Fruitvale, Idaho. 1910–
Lost Creek near Tamarack, Idaho, 1911–
Middle Fork of Weiser River at Middle Fork, Idaho, 1910–
Crane Creek near Midvale, Idaho, 1910–
Mann Creek near Weiser, Idaho, 1911–
Monroe Creek (upper station) near Weiser, Idaho, 1912–
Monroe Creek (lower station) near Weiser, Idaho, 1912–
Powder River at Salisbury, Oreg., 1903–1911.
Powder River near Baker, Oreg., 1912–
Powder River near North Powder, Oreg., 1909–
North Powder River near North Powder, Oreg., 1912–
Eagle Creek above West Fork near Baker City, Oreg., 1911.
Eagle Creek near Baker City, Oreg., 1909–10.
West Fork of Eagle Creek near Baker City, Oreg., 1911.
Salmon River near Pierson, Idaho, 1911–
Salmon River at Salmon, Idaho, 1912–
Salmon River near White Bird, Idaho, 1910–
Lake Creek near Stanley, Idaho, 1910–
Valley Creek near Stanley, Idaho, 1910–
Pahsimeroi River near Goldburg, Idaho, 1910–
Goldburg Creek near Goldburg, Idaho, 1910.
Big Creek near Patterson, Idaho, 1910–
Timber Creek near Leadore, Idaho, 1912–
West Fork of Timber Creek near Leadore, Idaho, 1912–
Eightmile Creek near Leadore, Idaho, 1912–
North Fork of Salmon River near North Fork, Idaho, 1912–

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Salmon River tributaries—Continued.
Grande Ronde River at Hilgard, Oreg., 1903–
Grande Ronde River at Elgin, Oreg., 1903–
Grande Ronde River at Zindel, Wash., 1904–
Catherine Creek near Union, Oreg., 1906–7; 1911–
Wallowa Lake (on Wallowa River) near Joseph, Oreg., 1905–
Wallowa River near Wallowa, Oreg., 1903–1907.
Wallowa River at Minam (near Elgin), Oreg., 1903–
South Fork of Wallowa River near Lostine, Oreg., 1912–
Minam River at Minam, Oreg., 1912–
Asotin Creek near Shelmans ranch near Asotin, Wash., 1904–1906.
Asotin Creek near Asotin, Wash., 1904–5; 1911.
Selway River (head of Clearwater River), near Lowell, Idaho, 1911–
Clearwater River at Kamiah, Idaho, 1910–
Clearwater River near Lewiston, Idaho, 1910–
Lochsa River near Lowell, Idaho, 1910–
South Fork of Clearwater River near Grangeville, Idaho, 1911–
South Fork of Clearwater River at Kooskia, Idaho, 1911–
Lolo Creek at Greer, Idaho, 1912–
Palouse River at Elberton, Wash., 1904–5.
Palouse River at Hooper, Wash., 1897–
Rock Creek near St. John, Wash., 1903–1905.
Cow Creek near Keystone, Wash., 1904–5.
Cow Creek near Hooper, Wash., 1904.

Canals in Snake River basin.

Upper Snake River basin:
Idaho canal near Shelley, Idaho, 1912–
North side Minidoka canal near Minidoka, Idaho, 1909–
South side Minidoka canal near Minidoka, Idaho, 1909–
North side Twin Falls canal near Milner, Idaho, 1909–
South side Twin Falls canal near Milner, Idaho, 1909–
Fort Hall upper canal near Blackfoot, Idaho, 1912–
Fort Hall lower canal near Blackfoot, Idaho, 1912–
Sharp ditch near Mackay, Idaho, 1912–
Streeter ditch near Mackay, Idaho, 1913–
Buckaroo ditch near Hot Spring, Idaho, 1912–
Grandview canal near Comet, Idaho, 1912–
Wilson ditch near Ontario, Oreg., 1904–5.
Owyhee River basin:
Owyhee ditch near Owyhee, Oreg., 1904–5; 1911–
Malheur River basin:
Vines ditch above Vale, Oreg., 1904–5.
Malheur Farmer's canal above Vale, Oreg., 1904–5.
McLaughlin ditch above Vale, Oreg., 1904–5.
"J. H." ditch above Vale, Oreg., 1904–5.
Gellerman & Frohman ditch above Vale, Oregon, 1904–5.
Sand Hollow ditch above Vale, Oreg., 1904–5.
Hope Mill ditch at Vale, Oreg., 1905.
Nevada ditch below Vale, Oreg., 1904–5.

Columbia River tributaries—Continued.
Snake River canals.
On Wallowa River in Grande Ronde basin:
Silver Lake ditch near Joseph, Oreg., 1905.
Farmers and Citizens ditch near Joseph, Oreg., 1905.
Granger ditch at Joseph, Oreg., 1905.
Big Bend ditch at Joseph, Oreg., 1905.
Company ditch near Wallowa, Oreg., 1905.
Walla Walla River near Milton, Oreg., 1903–
Walla Walla River at Whitman, Wash., 1897–1899.
South Fork of Walla Walla River near Milton, Oreg., 1903–
Umatilla River at Gibbon, Oreg., 1896–
Umatilla River at Pendleton, Oreg., 1891–92; 1903–1905.
Umatilla River near Yoakum, Oreg., 1903–
Umatilla River near Umatilla, Oreg., 1903–
North Fork of Umatilla River near Gibbon, Oreg., 1912–
McKay Creek near Pendleton, Oreg., 1903–4.

Canals in Umatilla River basin.

Farmers' mill ditch at Pendleton, Oreg., 1906.
Slusher & Gould ditch near Nolin, Oreg., 1905.
Lisle & Crane ditch near Echo, Oreg., 1905.
Charles Lisle ditch at Echo, Oreg., 1905.
Henrietta mill ditch at Echo, Oreg., 1905.
Wilson & Co.'s ditch at Echo, Oreg., 1905.
Allen ditch at Echo, Oreg., 1905.
Hinckle ditch at Echo, Oreg., 1905.
Pioneer ditch at Echo, Oreg., 1905.
Maxwell ditch at Echo, Oreg., 1905.
Hermiston ditch near Hermiston, Oreg., 1905.
Beitle ditch near Hermiston, Oreg., 1905.
Oregon Land & Water Co.'s ditch at Umatilla, Oreg., 1905.
Brownell ditch at Umatilla, Oreg., 1905.

Willow Creek near Arlington, Oreg., 1905–6.
Rock Creek near Goldendale, Wash., 1912–
Squaw Creek near Goldendale, Wash., 1912–
John Day River near Dayville, Oreg., 1908–
John Day River at McDonald, Oreg., 1904–
South Fork of John Day River at Dayville, Oreg., 1908–
Dayville ditch at Dayville, Oreg., 1910–
Rock Creek near Arlington, Oreg., 1905; 1911.
Big Marsh outlet on Deschutes River near Crescent, Oreg., 1912–
Deschutes River near Crescent, Oreg., 1912–
Deschutes River near Lapine, Oreg., 1910–
Deschutes River at Allen's ranch near Lava, Oreg., 1905; 1908–
Deschutes River at West's ranch near Lava, Oreg., 1906–1909.
Deschutes River at Benham Falls, Oreg., 1909–
Deschutes River at Bend, Oreg., 1904–
Deschutes River at Laidlaw, Oreg., 1909–
Deschutes River near Cline Falls, Oreg., 1910–
Deschutes River at Mecca, Oreg., 1911–
Deschutes River at Moro, Oreg., 1897–1899.

Columbia River tributaries—Continued.

Deschutes River at Moody (Biggs), Oreg., 1906– (replaces Moro station).
Crescent Lake outlet near Crescent, Oreg., 1911–
East Fork of Deschutes River at Crescent, Oreg., 1904–1908; 1910–
West Fork of Deschutes River near Lapine, Oreg., 1910–
West Fork of Deschutes River near Lava, Oreg., 1905–1907; 1909–
Tumalo Creek near Laidlaw and Bend, Oreg., 1906–
Lewis Creek near Laidlaw, Oreg., 1908–9.
Squaw Creek and McAllister ditch near Sisters, Oreg., 1906–
Crooked River near Post, Oreg., 1908–1911.
Crooked River near Prineville, Oreg., 1908–
Ochoco Creek near Howard, Oreg., 1910–11.
Ochoco Creek and Elliott ditch near Prineville, Oreg., 1908–
Metolius River at Allingham ranger station, near Sisters, Oreg., 1910–
Metolius River at Hubbard's ranch, near Sisters, Oreg., 1910–
Metolius River at Riggs's ranch, near Sisters, Oreg., 1908–
Lake Creek near Sisters, Oreg., 1911–
Whitewater Creek near Sisters, Oreg., 1911–
Shitike Creek at Warmspring, Oreg., 1911–
Warm Spring River near Warmspring, Oreg., 1911–
White River near Tygh Valley, Oreg., 1911–
Tygh Creek at Tygh Valley, Oreg., 1911–

Canals in Deschutes River basin.

Central Oregon canal near Bend, Oreg., 1910.
Pilot Butte canal near Bend, Oreg., 1910–
Wimer canal near Laidlaw, Oreg., 1906–
Columbia Southern canal near Laidlaw, Oreg., 1906–

Klickitat River near Glenwood, Wash., 1910–
Klickitat River above and below Big Muddy River near Wright, Wash., 1905; 1907–8.
Klickitat River at Camp Klickitat, Wash., 1908–9.
Klickitat River at Hanson's cable near Klickitat, Wash., 1908–9.
Klickitat River at Klickitat (Wright), Wash., 1907; 1909–
Klickitat River at Wols Ferry, near Lyle, Wash., 1908–1910.
Klickitat River at Lyle, Wash., 1912–
Big Muddy River above mouth of Cougar Creek near Wright, Wash., 1905; 1908–1910.
West Fork of Klickitat River near Goldendale, Wash., 1910–
Little Klickitat River near Goldendale, Wash., 1910–1912.
Hood River at Winans, Wash., 1905–1907; 1910–1912.
Hood River at Tucker's bridge, Wash., 1897–1899.
White Salmon River at splash dam near Trout Lake, Wash., 1912–
White Salmon River at Husum, Wash., 1909–
Trout Creek at Guler, Wash., 1909–
Little White Salmon River below Lava Creek near Cooks, Wash., 1903–1906.[1]
Little White Salmon River near Cooks, Wash., 1909.
Latourelle Creek at Latourelle, Oreg., 1912–
Sandy River above Salmon River at Brightwood, Oreg., 1910–
Sandy River below Salmon River at Brightwood, Oreg., 1907–

[1] Results published in U. S. Geol. Survey Water-Supply Paper 272, pp. 428–429.

Columbia River tributaries—Continued.
Sandy River near Marmot, Oreg., 1911–
Sandy River above Bull Run River near Bull Run, Oreg., 1910–
Sandy River below Bull Run River near Bull Run, Oreg., 1910–
Still Creek near Rowe, Oreg., 1910–
Salmon River near Rowe, Oreg., 1910–
Bull Run River near Bull Run, Oreg., 1907–
Little Sandy River near Bull Run, Oreg., 1911–
Willamette River, Middle Fork (head of Willamette River), near Hazeldell, Oreg., 1911–
Willamette River, Middle Fork, at Jasper, Oreg., 1905–
Willamette River at Springfield, Oreg., 1912–
Willamette River at Eugene, Oreg., 1912–
Willamette River at Albany, Oreg., 1895–
Willamette River at Salem, Oreg., 1910–
Willamette River at Oregon City, Oreg., 1909–
Kelsey River near Hazeldell, Oreg., 1909.
North Fork of Middle Fork of Willamette River near Hazeldell, Oreg., 1909–
Big Fall Creek near Fall Creek, Oreg., 1912.
Coast Fork of Willamette River near Goshen, Oreg., 1905–1912.
Bow River near Disston, Oreg., 1910–
McKenzie River at Clear Lake, Oreg., 1912–
McKenzie River near McKinzie Bridge, Oreg., 1911–
McKenzie River at Martins Rapids, Oreg., 1910–
McKenzie River near Springfield, Oreg., 1905–
Eugene power canal near Walterville, Oreg., 1912–
Santiam River, North Fork (head of Santiam River), near Hoover, Oreg., 1907–
Santiam River, North Fork, at Niagara, Oreg., 1908–
Santiam River, North Fork, at Mehama, Oreg., 1905–1907; 1910.
Santiam River at Jefferson, Oreg., 1905–6; 1908–
Marion Fork of Santiam River at Marion Lake, near Hoover, Oreg., 1907; 1909–
Puzzle Creek near Detroit, Oreg., 1907; 1909–10.
North Fork of Puzzle Creek near Hoover, Oreg., 1909–
South Fork of Puzzle Creek near Hoover, Oreg., 1909–
Permelia Creek near Detroit, Oreg., 1907; 1909–
Whitewater Creek near Detroit, Oreg., 1907.
Breitenbush Creek near Detroit, Oreg., 1910–
South Fork of Santiam River near Cascadia, Oreg., 1910–
South Fork of Santiam River near Foster, Oreg., 1911.
South Fork of Santiam River at Waterloo, Oreg., 1905–1907; 1910–
Middle Fork of Santiam River near Foster, Oreg., 1911.
Luckiamute River near Suver, Oreg., 1905–1911.
Yamhill River, South Fork (head of Yamhill River), at Sheridan, Oreg., 1906–
Yamhill River at La Fayette, Oreg., 1908–
Molalla River near Molalla, Oreg., 1905–1909.
Clackamas River near Cazadero, Oreg.,[1] 1909–
Clackamas River at Estacada, Oreg., 1908–1911.

[1] Evaporation records 1909–10; 1912–

Columbia River tributaries—Continued.
Willamette River tributaries—Continued.
Clackamas River near Barton, Oreg., 1905–1908 (replaced by Estacada station).
Clackamas River at Park Place, Oreg., 1912–
Lewis River above Muddy River near Cougar, Wash., 1909.
Lewis River near Cougar, Wash., 1909–
Lewis River near Amboy, Wash., 1911–
Lewis River at Ariel, Wash., 1909.
Muddy River at mouth, near Cougar, Wash., 1909.
Pine Creek at mouth, near Cougar, Wash., 1909.
Swift Creek at mouth, near Cougar, Wash., 1909.
Kalama River near Kalama, Wash., 1911–
Ohanapecosh River (head of Cowlitz River) near Lewis, Wash., 1911–
Cowlitz River near Lewis, Wash., 1911–
Cowlitz River at Randle, Wash., 1910–
Cowlitz River at Mayfield, Wash., 1910–11.
Clear Fork near Lewis, Wash., 1911–
Coal Creek near Lewis, Wash., 1911–
Lake Creek at mouth near Lewis, Wash., 1911–
Johnson Creek at mouth, near Lewis, Wash., 1911–
Cispus River near Randle, Wash., 1910–
Toutle River at St. Helen, Wash., 1909.
Toutle River near Castle Rock, Wash., 1909–

BETWEEN COLUMBIA RIVER AND PUGET SOUND.

Chehalis River near Centralia, Wash., 1910–11.
Queniult River near Quiniault, Wash., 1912–
Soleduck River near Quillayute, Wash., 1897–1901.
Kalawa River near Forks, Wash., 1897–1901.

PUGET SOUND DRAINAGE BASINS.

Elwha River at McDonald, Wash., 1897–1901.
Elwha River near Port Angeles, Wash., 1911–
Dungeness River at Seguin, Wash, 1897–98.
Dungeness River at Dungeness, Wash., 1897–1901.
Dosewallips River at Brinnon, Wash., 1910–11.
Duckabush River near Duckabush, Wash., 1910–
Skokomish River, North Fork (head of Skokomish River), near Hoodsport, Wash., 1910–11.
Nisqually River near Ashford, Wash., 1910–
Nisqually River near La Grande, Wash., 1906–
Puyallup River near Electron, Wash., 1911–
Carbon River at Fairfax, Wash., 1910–
White River below Forks, near Enumclaw, Wash., 1912–
White River at Buckley, Wash., 1899–1903; 1910–
Greenwater River at mouth, near Enumclaw, Wash., 1912–
Green River at Kanaskat, Wash., 1911.
Cedar River at Vaughn Bridge, near Cedar Lake, Wash., 1898.
Cedar River at Cedar Lake near North Bend, Wash., 1902–3.
Cedar River near Ravensdale, Wash., 1902–
Cedar River near Seattle, Wash., 1895–1898.

Skykomish River, South Fork (head of Skykomish River), near Berlin, Wash., 1910–11.
Skykomish River at Sultan, Wash., 1910–11.
Foss River near Skykomish, Wash., 1911–
East Fork of Foss River near Skykomish, Wash., 1911.
Miller Creek near Berlin, Wash., 1911–
West Fork of Miller Creek near Berlin, Wash., 1911–
North Fork of Skykomish River at Index, Wash., 1910–
Snoqualmie River at Snoqualmie Falls, Wash., 1902–1906.
Pilchuck Creek near Granite Falls, Wash., 1911.
Stillaguamish River, South Fork (head of Stillaguamish River), near Silverton, Wash., 1910–
Stillaguamish River, South Fork, near Robe, Wash., 1902.
Stillaguamish River, South Fork, near Granite Falls, Wash., 1911–
Canyon Creek near Granite Falls, Wash., 1912–
Skagit River near Marblemount, Wash., 1908–
Skagit River near Sedro Woolley, Wash., 1908–
Cascade River near Marblemount, Wash., 1909–
Sauk River above Whitechuck River near Darrington, Wash., 1910.
Sauk River above Clear Creek near Darrington, Wash., 1910–
Sauk River at Suiattle Crossing, near Sauk, Wash., 1910–
Whitechuck River near Darrington, Wash., 1910.
Clear Creek near Darrington, Wash., 1910–
Baker Lake (on Baker River) near Concrete, Wash., 1910–
Baker River below Anderson Creek, near Concrete, Wash., 1910–
Baker River at Concrete, Wash., 1910–
Whatcom Creek near Bellingham, Wash., 1910–
Nooksack River, North Fork (head of Nooksack River), near Glacier, Wash., 1910–11.
Nooksack River near Deming, Wash., 1910–11.
Middle Fork of Nooksack River at ranger station, near Deming, Wash., 1910–11.
Middle Fork of Nooksack River near Deming, Wash., 1910–11.

REPORTS ON WATER RESOURCES OF THE NORTH PACIFIC SLOPE DRAINAGE BASINS.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*53. Geology and water resources of Nez Perce County, Idaho, Part I, by I. C. Russell. 1901. 86 pp., 10 pls. 10c.

*54. Geology and water resources of Nez Perce County, Idaho, Part II, by I. C. Russell. 1901. 87–141 pp.

Nos. 53 and 54 relate to an area "in western Idaho, bordered on the west by portions of Washington and Oregon," drained through Snake River to the Columbia; they describe the topography, geology, and soils of the region, discuss the relation of the surface features—plateaus, canyons, streams, etc.—to the geology and the climate, the source and quantity of the water supply, including springs and artesian wells, and refer briefly to the occurrence of building stones, lignite, gold, silver, and copper. They include also a short bibliography of artesian waters and two appendices—one giving list of elevations, and the other, notes concerning Portland cement.

55. Geology and water resources of a portion of Yakima County, Wash., by G. O. Smith. 1901. 68 pp., 7 pls. 10c.

Describes topography, climate, soil, agriculture, geologic and surface and underground waters of an area comprising about 50 square miles in the vicinity of North Yakima; discusses in some detail the artesian basins and wells.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls. 5c.

Discusses briefly the rocks and geologic structure of a part of the Snake River plains in Canyon and Owyhee counties, Idaho, and Malheur and Harney counties, Oreg.; describes briefly the condition on which artesian flow depends, and in some detail the springs and drilled wells in the Lewis, Otis, Harney, and Whitehorse artesian basins; also describes artesian wells in alluvial deposits and discusses the size of drill holes, casings, etc., the preservation of well records, and the importance of laws to govern the use of artesian waters; gives list of publications bearing on artesian waters.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer, 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Investigations in Idaho, by D. W. Ross. Describes the irrigable lands in the area drained by Snake River.

Investigations in Oregon, by J. T. Whistler. Mentions the Umatilla, Malheur, and Harney projects.

Work in Washington, by T. A. Noble. Describes the plains of Columbia River.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives an account of a flood (commonly spoken of as the "Heppner disaster") on Willow Creek, a tributary of Columbia River, in Morrow County, Oreg.

111. Preliminary report on the underground waters of Washington, by Henry Landes. 1905. 85 pp., 1 pl. 10c.

Describes, by counties, the municipal water supplies, deep wells, and springs in the State, giving also for each county a brief account of the climate, rainfall, topography, drainage, and geology.

118. Geology and water resources of a portion of east-central Washington, by F. C. Calkins. 1905. 96 pp., 4 pls. 5c.

Describes briefly the topography, geology, climate, vegetation, grazing, and agriculture on the Columbia Plains and in the Kittitas Valley; discusses the streams, springs, and shallow and deep wells.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates (p. 85) of flood discharge and frequency for Boise River at Boise and Weiser River at Weiser, Idaho; also index to literature on floods on American streams.

253. Water powers of the Cascade Range, Part I: Southern Washington, by J. C. Stevens. 1910. 94 pp., 21 pls. 40c.

Discusses conditions governing hydraulic development, water laws of Washington, and variations in streams; describes the drainage basins of Klickitat, White Salmon, Little White Salmon, Lewis, and Toutle rivers; gives results of observations at gaging stations, estimates of average minimum discharge, and of the available horsepower at the power sites.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Boise, Malheur, Payette, and Palouse rivers, and Salmon Creek.

313. Water powers of the Cascade Range, Part II: Cowlitz, Nisqually, Puyallup, White, Green, and Cedar drainage basins, by F. F. Henshaw and G. L. Parker. 1913. 170 pp., 16 pls. 55c.

Describes the geologic features and history of the drainage basins, topography and drainage, soils and vegetation, and precipitation; gives stream flow records and discusses water powers, storage, and power sites; discusses also natural resources and harbors of the Pacific Coast, central electric stations, and power utilization, and gives commercial and residential rates. (See also 253.)

316. Geology and water resources of a portion of south-central Washington, by G. A. Waring. 1913. 46 pp., 1 pl. 5c.

Describes settlements, climate and vegetation, agriculture, grazing, geographic province, relation of surface features and structure, and geology; discusses shallow and artesian waters and irrigation enterprises in Sunnyside and Reservation valleys, Horse Heaven Plateau, and the Columbia River plains, and irrigation along lower Yakima River; gives tabulated data concerning wells and springs.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form. Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, pp. xiv, 395. 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River Basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts, Pt. III, Irrigation, pp. xi, 486, 77 plates. $1.85. Contains:

*Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, Pls. cxlvii–clxxxii. Describes structures on the Pocatello Canal, Idaho.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, pp. xvii, 400, 110 plates, $1.25. 16 maps in separate case, 75c. Contains:

*Priest River Forest Reserve, by J. B. Leiberg, pp. 217–252, Pls. XLVI–LXI.

*Bitterroot Forest Reserve, by J. B. Lieberg, pp. 253–282, Pls. LXII–LXXIII.

*Washington Forest Reserve, by H. B. Ayres, pp. 283–313, Pls. LXXIV–C.

*Eastern part of Washington Forest Reserve, by M. W. Gorman, pp. 315–349, Pl. CI.

*Forest conditions of northern Idaho, by J. B. Leiberg, pp. 373–386, Pls. CIX–CX.

These reports describe the topography and the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, pp. xix, 498, 159 plates, 8 maps in separate case. $2.80. Contains:

*Flathead Forest Reserve, by H. B. Ayres, pp. 245–316, Pls. LXXVI–CXIII.

*Bitterroot Forest Reserve, by J. B. Leiberg, pp. 317–409, Pls. CXIV–CXLII. Contains brief descriptions of the streams and lakes in the reserves, state that the water is too poor for use for irrigation.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, 711 pp., 143 pls., 39 maps in separate case. $3.85. Contains:

*Mount Rainier Forest Reserve, Washington, by F. G. Plummer, pp. 81–143, Pls. XXXIII–L.

*Olympic Forest Reserve, Washington, from field notes by Arthur Dodwell and T. F. Rixon, pp. 145–208, Pls. LI–LXX.

*Cascade Forest Reserve, Oregon, from T. 28 S. to T. 37 S., inclusive, together with the Ashland Forest Reserve and adjacent forest regions from T. 28 S. to T. 41 S., inclusive, and from R. 2 W. to R. 14 E., Willamette meridian, inclusive, by J. B. Leiberg, pp. 209–498, Pls. LXXXI–LXXXIV.

Contains descriptions of many of the streams flowing through the forest reserves.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*199. Geology and water resources of the Snake River Plains of Idaho, by I. C. Russell. 1902. 192 pp., 25 pls. 25c.

Describes the topography, geology, climate, vegetation, fauna, and soils of an area extending entirely across the southern part of Idaho; discusses streams, springs, water powers, irrigation and agriculture, industries, routes of transportation and highways; treats of the origin of surface and subsurface waters, the requisite conditions for artesian wells and the quantity of water available.

252. Preliminary report on the geology and water resources of central Oregon, by I. C. Russell. 1905. 138 pp., 24 pls. 15c.

Describes a portion of the extreme northern part of the Great Basin and a part of the drainage area of Deschutes River and its principal tributary, Crooked River; gives an account of the topography, drainage, rainfall and temperature, winds, and forests; describes the volcanic sedimentary rock formations, and discusses by counties the geology and topography, the surface and underground waters; treats of artesian conditions in the Deschutes basin and makes suggestions concerning artesian-well records.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Idaho, Montana, Nevada, Oregon, Washington, and Wyoming, and detailed records of wells in Benton, Jefferson, and Walla Walla counties, Wash. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The

[1] Index maps showing areas in the North Pacific slope basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy except folio 193, which sells for 75 cents a copy. For wholesale rate on folios see page 18.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*45. Boise folio, Idaho.

Describes geography and geology, cold springs and cold artesian waters, and hot springs and hot artesian waters.

103. Nampa folio, Idaho-Oregon.

Describes the relief, drainage, climate, and vegetation of the area; discusses the geologic history and geologic formations, and, under "Economic geology," the surface waters available for irrigation, the springs and shallow wells, and the artesian wells; indicates areas of possible artesian flow.

104. Silver City quadrangle, Idaho.

Describes the relief, drainage, climate, vegetation, and culture of the Silver City quadrangle; discusses the geologic history and the geologic formations, and, under "Economic geology," the surface waters available for irrigation or water-power development, warm springs, and artesian wells; notes possible chances for artesian waters; gives records of wells near Enterprise and Duffy; see also Water-Supply Paper 78.

139. Snoqualmie folio, Washington.

Describes the relief and drainage of an area including portions of Kittitas, Yakima, Pierce, and King counties; the stratigraphic, structural, and historical geology, and, under "Economic geology," includes a brief paragraph on the utilization of the water supply.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the northern Pacific coast drainage basins are the reports of

the commissioner of conservation [State of Montana]; the State land commission; the State engineer of Idaho; the Bureau of Industry, Agriculture, and Irrigation of Nevada; the State engineers of Nevada, Oregon, Utah, and Washington; the annual reports of the United States Reclamation Service; and the reports of the Chief of Engineers, U. S. Army. The following reports deserve special mention:

The Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912.

State and National water laws, with a detailed statement of the Oregon system of water titles, by John H. Lewis, with a discussion by Clarence T. Johnston and L. J. Le Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637–758, 1913.

Report of the commissioner of conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests: Helena, 1911; also report of the governor of the State of Montana on the same subject.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the preparation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bur. of Industry, Agr., and Irr. Bull. 8, 1913.

The water resources of Washington: Potable and mineral water, by L. G. Byers; artesian water, by C. A. Ruddy; water power, by R. E. Heine: Washington, Geol. Survey Ann. Rept. for 1901, vol. 1, pt. 5, 1902.

Preliminary report on the Quincy Valley irrigation project, by Henry Landes and others: Washington, Geol. Survey Bull. 14, 1912.

Biennial Report of the State Commission of Arid Lands [Washington], 1895–96 and 1897–98.

The irrigated lands of the State of Washington, by George M. Allen, deputy commissioner: State Bureau of Statistics and Immigration, 1910.

Irrigation laws of the State of Wyoming, prepared for publication in the office of the State engineer, 1909.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations.

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kansas; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

32. Water resources of Puerto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. 15c.

Describes briefly topography, climate, rivers, irrigation methods, soils, forestation, water power, and transportation facilities.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 15c.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distance along rivers of the United States, also brief descriptions of many of the streams. Arrangement geographic. Many river profiles are scattered through other reports on surface waters in various parts of the United States.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. (See also Nos. 64, 94, and 95.)

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

77. The water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls. 10c.

Describes briefly the topography, geology, coral reefs, climate, soils, vegetation, forests, fauna of the island, the springs, running streams, and wells, and discusses the utilization of the surface and underground waters.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane-table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

95. Accuracy of stream measurements (second, enlarged, edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States; by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

Notes on the hydrology of Cuba, by M. L. Fuller.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste.

The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formation, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

115. River surveys and profiles made during 1903, by W. C. Hall and J. C. Hoyt. 1905. 115 pp., 4 pls. 10c.

Contains results of surveys made to determine location of undeveloped power sites.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.

Power engineering applied to irrigation problems, by O. H. Ensign.

Estimates on tunneling in irrigation projects, by A. L. Fellows.

Collection of stream-gaging data, by N. C. Grover.

Diamond-drill methods, by G. A. Hammond.

Mean-velocity and area curves, by F. W. Hanna.

Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.

Effect of aquatic vegetation on stream flow, by R. E. Horton.

Sanitary regulations governing construction camps, by M. O. Leighton.

Necessity of draining irrigated land, by Thos. H. Means.

Alkali soils, by Thos. H. Means.

Cost of stream-gaging work, by E. C. Murphy.

Equipment of a cable gaging station, by E. C. Murphy.

Silting of reservoirs, by W. M. Reed.

Farm-unit classification, by D. W. Ross.

Cost of power for pumping irrigating water, by H. A. Storrs.

Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

*151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp.

Scope indicated by title.

155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905, lists of publications relating to underground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

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*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl. 10c.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*196. Water supply of Nome region, Seward Peninsula, Alaska, 1906, by J. C. Hoyt and F. F. Henshaw. 1907. 52 pp., 6 pls. 15c.

Gives results of measurements of flow of Alaskan streams, discusses available water supply for ditch and pipe lines and power development; presents notes for investors.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*218. Water-supply investigations in Alaska, 1906–7 (Nome and Kougarok regions, Seward Peninsula; Fairbanks district, Yukon-Tanana region), by F. F. Henshaw and C. C. Covert. 1908. 156 pp., 12 pls. 25c.

Describes the drainage basins, gives results of observations at the gaging stations, and discusses the water supply of the ditches and pipe lines, and possibilities of development; gives also meteorological records.

*226. The pollution of streams by sulphite pulp waste, a study of possible remedies, by E. B. Phelps. 1908. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

228. Water-supply investigations of the Yukon-Tanana region, Alaska, 1907 and 1908 (Fairbanks, Circle, and Rampart districts), by C. C. Covert and C. E. Ellsworth. 1909. 108 pp., 7 pls. 20c.

Describes the drainage basins; gives results of observations at gaging stations; discusses the water supplies of the ditches and pipe lines and possibilities of hydraulic development.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water papers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parke.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool-scouring, bleaching, and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one-hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 125 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*259. The underground waters of southwestern Ohio, by M. L. Fuller and F. G. Clapp, with a discussion of the chemical character of the waters, by R. B. Dole. 1912. 228 pp., 9 pls. 35c.

Describes the topography, climate, and geology of the region, the water-bearing formations, the source, mode of occurrence, and head of the waters, and municipal supplies; gives details by counties; discusses in supplement, under chemical character, method of analysis and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, or medicinal uses, methods of purification, chemical composition; many analyses and field assays. The matter in the supplement was also published in Water-Supply Paper 254 (The underground waters of north-central Indiana).

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

*280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

314. Surface water supply of Seward Peninsula, Alaska, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith, and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., 17 pls. 45c.

Contains results of work at gaging stations.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

*318. Water resources of Hawaii, 1909–1911, by W. F. Martin and C. H. Pierce. 1913. 552 pp., 15 pls. 50c.

Describes the general features of the islands and gives results of measurements of streams and of observations of rainfall and evaporation; contains a gazetteer.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 32 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

336. Water resources of Hawaii, 1912, by C. H. Pierce and G. K. Larrison. 1914. 392 pp. 50c.

Contains results of stream measurements on the islands in 1912.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlain, pp. 125 to 173, Pl. XXI. Scope indicated by title.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 368–561, Pls. CVII to CXLVI. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, Pls. CXI to CXLV. Discusses the economical aspects of irrigation, alkaline drainage, silt and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, pp. xx, 597, 73 pls. $2.10. Contains:

*Potable waters of the eastern United States, by W J McGee, pp. 1 to 47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, Pls. III and IV. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, papers chiefly of a theoretical nature, pp. v, 958, 172 plates. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, Pls. VI to XVII. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous media, and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, Pls. XVII. Scope indicated by title.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, vii, 660 pp., 75 plates. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563–637, Pls. LXIV to XXV. Describes the topographic features of the boundary, the lake basin, and Rio San Juan; gives a brief résumé of the boundary dispute, discusses rainfall, temperature, and relative humidity, evaporation, resources, and productions, the ship, railway, and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Juan and its tributaries.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. Pt. IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507–630, Pls. XXXVII to L. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharges of many of the streams, rainfall, and evaporation tables at various points.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Bulletins 264 and 298 discuss the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells by States, and detailed records selected as affording valuable stratigraphic information.

*319. Summary of the controlling conditions of artesian flows, by Myron L. Fuller, 1908. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

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